ELECTRICAL REVIEW

[ILLUSTRATED.]

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The Pratt Telephone System.

From the first inception of a talking machine, there seems to have been an almost constant traveling in one beaten track. The road marked out by the earliest inventor, whether that honor be awarded to Bell, Reiss, Gray, or somebody else—with that the present article has nothing to do—the use of the electro-magnet has apparently been deemed the only method by which vocal vibrations might be made available at a distance; and until the advent of the present instrument, the Pratt system, this was the only method practicable for such purposes.

A radical departure from the magneto principle is the Pratt instrument. The receiver dispenses with the magnetic core of the Bell and all the other claimants for priority in the electro-magnet forms of telephone, and uses instead a solenoid, as will be shortly explained. It is an interesting study to trace the similarities and differences between coils with and without cores. It is claimed on the one hand that a solenoid is an electro-magnet, while on the other side this is denied, and the claim set up that in an electro magnet the core is an essential and necessary portion of the instrument. It is no part of this article to enter into abstruse scientific disputation, but merely to explain the workings of a novel and original idea well worked out.

Some years ago Mr. Harry P. Pratt, of Chicago, conceived the idea of using a solenoid in lieu of an electro-magnet, and with commendable perseverance he carried his investigations and experiments far enough to warrant his applying for patents covering his system. In October, 1883, he made his first application, and was at once confronted by interferences and objections which hindered the granting of the patent for over one year, and it was not finally issued until January 20, 1885. Since the first application, the way has been something smoother, and patents covering the entire system as shown in Figs. 1 and 2, have been secured.

Fig. 1 represents the outfit as it hangs upon the wall in the subscriber's premises. A portion of the battery-box is broken away, showing the battery, which is of the Fuller form, and consists of three jars, disposed as shown in Fig. 2.

Fig. 2 shows the entire system in detail. A represents the receiver, which is a radical departure from the traditional butter-stamp form, and when one is accustomed to its use, much more convenient to handle and lighter as well. This is shown at the right bottom of the figure connected up with the induction coils, and again in section to the left of this detached. The coil *a* in this receiver is of but four ohms resistance. This coil *a*, lies between two diaphragms, the bottom one *b* quite thick and heavy, and in contact, while the upper *c* is very much thinner and separated a trifle from the coil. The coil has an opening shown in both views from top to bottom, and also an annular air-space surrounding it. The coil is held away from the case as shown. This air-space is deemed quite essential to good work. At *d* are shown the screw fastenings by which the lower diaphragm is held in position in the case, of which *E* is a final portion.

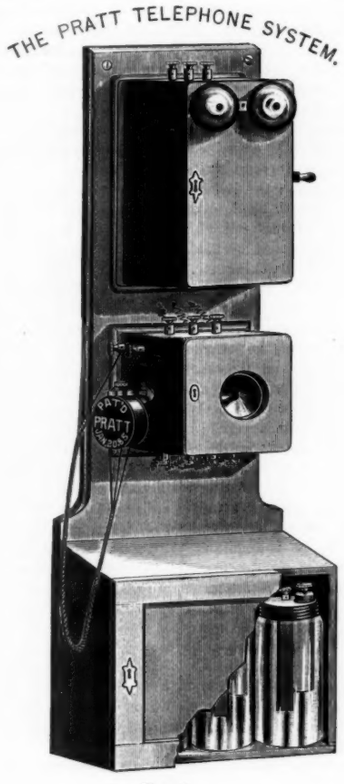


Fig. 1.

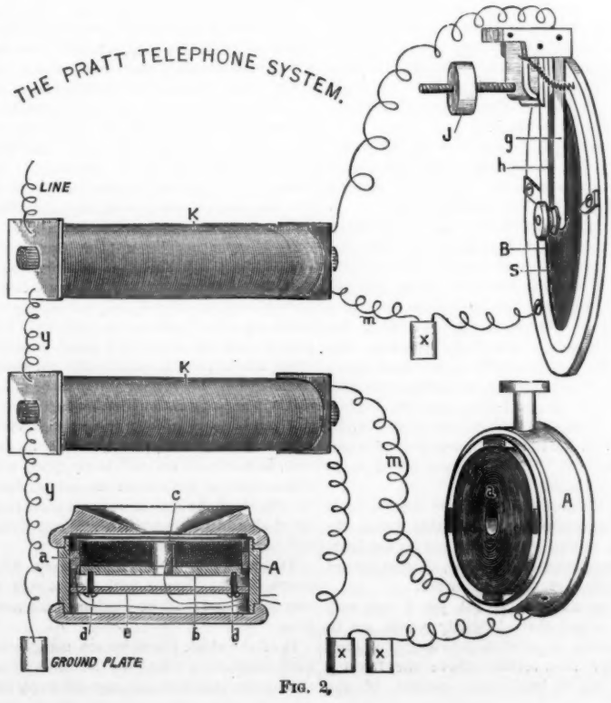


Fig. 2.

The transmitter is shown above the receiver. In this the contact-plates, *g* and *h*, are shown on the rear of the diaphragm, the former holding the platinum, and the latter the carbon contact. *J* is the adjustable weight for regulating the contact pressure, *B* the diaphragm. There are two induction coils, *K K*. The primary of each of these, marked *m*, has but five-tenths of an ohm resistance. One of these, the transmitter primary, has one cell or battery only. The receiver primary has two cells, represented by *X*. These two primary circuits are independent of each other, but the secondary circuit *y* passes from ground through both coils and to line.

Like all systems of electrical apparatus, of whatever nature, this has been a constant and prolific source of experiment in searching for the best results, and the present simple and compact form is the crystallized conclusion of an almost infinite number of attempts.

The claim for this telephone is that it is a substitute for the magneto of different construction, that it acts differently electrically, and that it produces an improved result, rendering telephone service easy, convenient and agreeable.

There is an old, trite saying that anybody can make a statement, but proof is necessary to conviction. This part of the matter is easily demonstrated. There are in Chicago splendid opportunities for testing the comparative efficiency of this and other systems, and the difference is truly wonderful.

The marked absence of interfering noises in the Pratt instruments, on the same circuits where otherwise these annoyances are excessive, surprises every one who tries to experiment.

Whether this is due to the cutting down of the initial force, and so reducing the useful as well as the annoying inductive effects until the latter are practically reduced to zero, and the former, while faint, have full possession of the field, or some disturbing agency resident in the magnet core is done away with by eliminating this from the combination, makes no sort of difference to the average user of the telephone. Two points are well established. The Pratt telephone does do its work in clear—not loud—clean tones without useless mouthing and sputtering, and other systems on the same wire do not. And what more markedly separates this from the magneto systems of telephone, is the fact that the line will not work satisfactorily with part of the Pratt system. A Pratt receiver cannot be substituted for a Bell, for instance, and made to work. The whole system must go together.

The Pratt telephone system is owned and controlled, both in this and foreign countries, by an organization in Chicago known as the Pratt and Plum Telephone Trust.

*** The American Bell Telephone Company makes public its statement of telephone output for the month ended February 20. It is very favorable, showing that the gross output was 3,223 instruments, against 1,958 in 1885; instruments returned during the month 1,408, against 2,552 last year, making the net output 1,815 instruments, against a net loss of 594 in 1885, a gain of 2,409 this year.

Chas. J. Van Depoele on Electric Motors.

The following is the complete paper of Mr. Chas. J. Van Depoele, read at the National Electric Light Association, at the Baltimore meeting:

To the National Electric Light Association.

GENTLEMEN I appreciate highly the honor you conferred upon me at the last meeting held in New York, in appointing me to make a report with regard to the progress made in the electrical transmission of power, and I only regret not to be able at present to give a more detailed account of what has been done, however, I shall endeavor to show that electrical transmission can be used with economy on ordinary street railways, doing away with horses or with dummy steam-engines; and in the absence of other data at command, I will take the liberty to give you my own experience of the past few months, if this may be acceptable to your honorable body.

During the summer months of 1885, I entered into a contract with the directors of the Toronto (Ontario) annual exhibition, to run a train of three cars and a motor car, from the street railway terminus to the upper grounds of the exposition, a distance of a mile. Having only a single track, I had to prepare here for a light train and good speed. The plant consisted of the following: One steam-engine, 10x16, running 125 revolutions per minute, driving an ordinary 40-light arc machine, having an electromotive force of about 1,400 volts, and an intensity of current of about 18 amperes. The engine and dynamo were placed in Machinery Hall, close to the boiler-room.

The dynamo was connected: one pole with the rails, which were fastened together by means of fish-plates, and the other pole to an overhead wire, hanging over the center of the track, by means of arms extending from poles placed along the length of the track On top of the car on which the motor was placed, was a contact wheel, carried by a pivoted beam, the latter being provided with a spring, on one end pressing the wheel at the other end up against the underside of the overhead wire; this contact wheel was in communication, by means of a flexible cable, with the switches, rheostat and motor. From the motor the current was carried to the axles of the wheels, the wheels to the track, thus closing the circuit upon the generator.

We began placing poles, etc., on the 1st of September, and made our first trip on the 5th of September. From beginning till end not the slightest hitch occurred, running regularly from 8 A. M. till 10.30 P. M., without stopping a minute. On many occasions, we carried from 225 to 250 people. On one end of the track we had a 200-feet curve to start, then a level of some 2,000 feet, with two curves of about 1,000 feet radius, then a grade of some 1,500 feet, gaining gradually to about six per cent. The rest of the road had a downward grade up to the terminus, which made it a disadvantage in starting. As above said, the distance was a mile, and the round trip never exceeded eight minutes; so, including starting and stopping, we made, for part of the way, at least thirty miles per hour. During the last five days of the fair, we carried 50,000 (fifty thousand) people. The consumption of coal, as given by Doty & Sons, who ran the engine, was on an average of 1,000 lbs. in ten hours.

The next step was to South Bend, Ind., where we equipped four ordinary street cars: one large open car, with a 10 horse-power motor, and the other three closed cars each with a 5 horse-power motor. The large car was run for the first time on Nov. 14, 1885, and was packed with humanity to its utmost capacity; everything worked like a charm. The plant consists at present of the following: A 50 horse-power water-wheel and two 20 horse-power generators, and, as above stated, one 10 and three 5 horse-power motors. The track is laid with the ordinary flat rail; so in order to connect the rails together, we placed copper plates, 3"x12", under the joints, and spiked the rails down upon the copper plates; this was done on both sides of the track, so there is no chance of breaking circuit As will be understood, the rails, in the present case, form again one part of the circuit; the other part consists of a copper wire, ¼ inch diameter, suspended above the track, from cross-wires fastened to poles placed near the curbstone, and at a distance of about 100 feet apart. From the underside of this copper wire or conductor hangs a carriage, fastened to a flexible cable, passing to the inside of the car, where it is in connection with the switches, the motor, etc. This carriage travels along with the car, and makes a perfect contact. After the first trial, of Nov. 14th, the 5 horse-power motors were soon in place, and have worked admirably well. The tracks are never perfectly clean, on account of constant traffic over the road; but since both rails are connected, and also all four of the wheels, it is almost impossible to break circuit between the motor and the rails. The cars have run right along, through mud and snow, and no trouble has been experienced with the circuit.

On running the four cars at once, the generators work perfectly, from 6 at morning till 11 P. M., requiring not the slightest attention, the brushes are set in the morning and are not touched afterward. Every car works independently, back or forward, without interfering with the others; the division of the current leaves nothing to be desired. The only trouble we have encountered with the plant has been with some small mechanical details, such as link belts breaking, etc., these of course, being small matters, are easily perfected. The main point here was the electrical part, and this has proved to be an unqualified success; there is no wear to speak of on the generators, and the same can be said of the motors. The motors are placed under the cars, between the wheels, and connected to the axles by means of link belting. At either end of the car is placed a dial-plate fastened to the dash-board, over one-half of this plate moves a handle directing the motion of the car either forward or backward; over the other half is another handle, by which the speed is regulated. When full current is turned on, the maximum speed of 8 miles per hour is attained, and this speed cannot be surpassed. Six to 8 miles per hour being the maximum speed allowed within the city limits on any ordinary tramway.

The length of the present road is about 2½ miles, the other roads will be equipped as soon as the weather allows of the placing of the poles for the cross wires.

On the 6th day of October, 1885, we entered into a contract with Mr. McCannico, President of the New Orleans Exposition, to run a train of cars in the grounds, with a carrying capacity of from 180 to 200 people. This road is similar to the one in Toronto, nearly a mile long, running from St. Charles street main entrance, along the Government Buildings, through the grounds, to the main building and Art Hall.

All was ready for operation for the opening day, but on account of delay in obtaining steam power, we only began running regularly on the 14th of December.

The generator is run by an engine 12x18, running 100 revolutions per minute; the generator is of 35 horse-power capacity; the motor is placed in the center of an open car, only taking away the two middle seats, thus leaving the other seats for the public. Besides this, are two more large open cars. The car containing the motor is provided with a contact wheel pressing up against the under side of the overhead wire, as in the Toronto road. This train runs regular from 8 A. M. to 7 P. M., and has up to date proved a perfect success. The maximum speed is 15 miles per hour.

The heaviest work we have done so far is in Minneapolis, Minn., and that during the winter months when snow and ice are faithful companions on the track; whether invited or not, they are there, never fail.

Before undertaking the job I was very much afraid that electricity would not be practicable in a climate where the thermometer rises seldom above the freezing point, for at least three months of the year. All my fears, however, have been removed in the past six weeks; we have ascended the grade and turned the curves with at least as much facility as the steam dummies. On one occasion the steam dummy brought us down to the road where we had our electrical connections. The steam dummy got stuck with our motor car and a large open car, the latter about fifty feet long; we dismissed the dummy, and as soon as we had current on we furrowed our way through the snow and had the track clear in a short time. This proves that we could do at least as much as the dummy.

A brief description of the track will give an idea of the work done by the motor.

Starting from Bridge square is a curve sixty feet radius; the road is then straight for about a mile, but rises and falls continually until 13th is reached, here is another curve of fifty feet radius to the right, one block further is a similar curve to the left, the rest of the road straight, but continually rising up to 24th street, the top of the hill; the steepest grade is about fifteen hundred feet long, and six per cent. beyond this is a switch and the termini of our present electrical equipment.

The electrical plant consists at present of one 60 horse-power generator and a 50 horse-power motor. Our circuit consists of the rails for one side and an overhead wire, 3 10 inch copper for the other side.

In South Bend, we have water-power as the prime motor. We ran for the first time on New Year's Eve, 1885, and continued on New Year's Day. The water-wheel had no governor and we found it rather dangerous for the generator; as the water-wheel had to be governed by hand, it was impossible to keep the speed anywhere near constant. It was decided to put a governor on before running regularly. Several trips, however, were made over the entire length of the road, giving entire satisfaction. The weight of the motor is 3,500 lbs., and the total weight of motor-car or electric locomotive is 3 tons. The passenger cars in use here are similar to those on the New York Elevated. While the water-governor was being made a steam-engine with a 12x18 cylinder, 125 revolutions per minute, was used, and although too small for the purpose, very satisfactory work has been done. In some instances we had three to four inches of solid ice on the track and broke our way through it without the least trouble; in a few days the water-power will be in shape to run regular, when we will run on schedule time.

Thus far we have demonstrated that electric railroads can be operated anywhere where the steam motor can go, and that there is much in favor of electric motors in cold countries, is very evident; there is no danger of pumps freezing up, nor of brakes becoming inoperative, no water-tanks are needed along the road, nor is there any coal to be taken; in fact, there are thousands of advantages in the application of the electric locomotive on street and other railroads. Whenever water-power is obtainable, the economy need not be disputed, and even in the case where steam is to be used as a prime motor, there will be considerable economy.

No cheaper nor better plant can be expected to run light trains on suburban roads than the electric motor, as for instance in the Detroit road now in progress, connecting the latter city with Dearborn. A single train will be run with six large-sized street cars, the speed will be from 15 to 20 miles per hour; the length of this road is nearly three miles, and will be in operation in a few weeks.

A similar road will be in operation early in the spring, in Appleton, Wis.; in this case, however, six cars will be equipped with 10 horse-power motors and run independent; the length of the road is about 8 miles; the speed about 10 miles per hour. Water-power will be used to run the generators.

The street railway in Montgomery, Ala., is now being equipped with our motors, 12 cars in all, and will be running within 30 days.

In all the above places we are using overhead conductors, which are no more of an obstruction than the ordinary telegraph and electric light wires, in fact much less, since the conductors are over the center of the reads; so wherever wires are allowed for other purposes, they cannot be refused for the present purposes. I do not believe, however, that overhead wires would be practicable in large cities where other wires have to be buried; but in this case the electric conductors can be placed under ground in conduits similar to those used for cable cars; this will be much more expensive than the overhead conductors, but it will be a permanent and practical fixture.

I feel sorry that I have not found more time to prepare some figures with regard to tests of motors and general transmission, but the above is a resume from practical experience and facts on the track instead of on paper. I am a solid believer in the saying that experience is the best teacher, and to all the above I have attended personally from beginning to end, and am more than ever convinced that electrical transmission of power has ceased to be ephemeral but has become a real fact and a blessing to the world; all is ready, it has only to be applied judiciously and success is imminent. Thousands of horse-power are now running waste in our water falls which can be all utilized to advantage, in some cases running our tramways, in others our factories, etc., giving at the same time light and cheer during the absence of old Sol.

GENTLEMEN:—With regard to the measuring of currents of high tension, I am unable to get anything ready for the present worth while, and I hope that this want will be filled by some of our worthy confreres. I may say here, however, that for the every-day practician, all there is needed is a good air and volt meter, direct reading. These instruments of different capacities can now be bought at reasonable prices. Duprez and Carpentier, of Paris, France, furnish a good instrument, and so Ayrton & Perry, of London, England, and many others. No company furnishing electric lights should be without a set of these instruments; they will be found most useful in many cases.

Respectfully yours,

CHAS. J. VAN DEPOELE.

Electricity as an Illuminant.

In the following brief review your committee on 'Electricity as an Illuminant," have thought it advisable to treat of the advance in electric lighting as having been marked by periods of activity. The present uniform development indicates the near approach of another period in the history of this new and great industry, when electric light will occupy the position now held by gas as an illuminant. The subject is one that engages universal public attention, owing to the extent and wide distribution of gas interests, and because of the possible effect the growth of electric lighting may have on the value of petroleum and natural gas *in situ*, as one of the future sources from which most illumination will be derived for use in the populous parts of the country.

In the conflict between electricity and gas as an illuminant, there is no point of advantage in favor of gas except its cheapness. But this advantage will every day diminish, while the superior healthfulness of electric light, and its greater safety against fire, and the ease with which it lends itself to decoration must force its acceptance by the public long before the equality of cost is reached.

We have divided a short history of electric light into five periods, which we will call by the following titles:

1st. The period of Davy.
2d. The period of Starr and Staite.
3d. The period of the Alliance machine.
4th. The period of the Paris Exposition.
5th. The coming period.

Each one of these four first epochs have been marked by some great and essential development in which electric lighting approached much nearer to perfection.

THE PERIOD OF DAVY.

In 1813 Sir Humphrey Davy was engaged in establishing his fame in a series of brilliant lectures at the Royal Institution. He

had decomposed the alkalies and had produced sodium and potassium in their metallic state by means of the powerful current from a battery of 2,000 zinc-copper elements. With these cells he was the first to make the electric light.

In his classical experiments he produced:

1. The arc light in air, and in the vacuum of an air pump.

2. The incandescent light in air, and in the vacuum of an air pump.

3. For these purposes he made use of small pencils and rods of carbon from vegetable fiber, and in the dense form of the diamond.

4. He discovered that a point of rarefaction in different gases could be reached where the arc would not pass.

Schemes of electric lighting as early as this may naturally have floated in the heads of visionary inventors; but if they ever experimented in this direction the rapid polarization of Sir Humphrey's primitive batteries and the difficulty of keeping an air pump tight, would soon have dispelled their hopes. Gas too, had just been introduced into London with great *eclat;* for we read of the vast illuminations made with it in honor of the crowned heads who visited that city after the fall of Napoleon I; and so electric lighs was laid aside.

From 1813, when Davy experimented with the electric light, until 1841, when Archereau and Deleuil used it to illuminate the Place de la Concorde in Paris, nothing seems to have been done to develop the necessary machinery for its automatic working, those gentlemen being compelled to push the carbons by hand, as they were consumed.

In the meantime, Grove (1832) had invented his depolarizing battery, and Bunsen had modified it by substituting carbon for platinum; and incidentally the latter had learned to make artificial carbon better adapted than wood charcoal for arc-lights.

So bright a light as that produced by Deleuil with 100 Bunsen cells, and one so well adapted for fine effects could not fail to attract inventors. In the same year, another departure in electric lighting, incandescence of platinum and charcoal, or plumbago *in vacuo*, was made by an Englishman named F. de Moleyns.

THE PERIOD OF STARR AND STAITE.

It was not, however, until 1845 that any serious attempt was made to introduce small electric lamps into public use, when J. W. Starr, a native of Cincinnati, went to England with an incandescent electric lamp, having a carbon made to give light while in Torricellian vacuum, and over mercury. Here, with the assistance of Mr. George Peabody, the banker, he introduced it, but soon after died.

The next year a very ingenious Englishman named Staite took up the subject of electric lighting, in all departments, and in a short space of time produced excellent arc lamps, embodying many principles now, or recently, in use. He also patented an incandescent lamp in which the illuminating organ made use of was iridium, as superior to platinum. He also much perfected the carbon used in arc-lighting.

The great difficulty in his way was the want of a cheap source of electricity, batteries being found too expensive. This defect prevented his success.

Here the matter seemed to rest (if we except Archereau's application of the Solenoid to arc-lamps, in 1848) until the invention of the dynamo machine furnished the missing link to the chain, which had to be wrought before electric light could be commercially produced.

It is, perhaps, well here to note that it is claimed by E de Changy, that he and M Jobard, of Brussels, in 1853, had made, but not operated, incandescent lamps, identical in form with lamps now in general use; but his claims are not substantiated.

It may also be mentioned that simultaneously with the invention of the dynamo-electric machine, a patent was taken out in England (by one Shepard) for a Belgian inventor named Nollet, presumably the same person as he who conceived the dynamo (now in operation) called after the company who manufactured it, the Alliance Machine, and which remarkable machine, when constructed and improved by Van Malderen, first rendered electric lighting feasible.

The perfect germs of this engine were, however, found buried in the small magneto-electric instruments of Pixii, Clarke and Page, which had been constructed almost immediately after Faraday announced his grand discovery of magnetic-electric induction.

It is also necessary to recall that Elias and Stohrer, in 1844, King in 1846, Dujardin in 1847, Henly in 1849, had already done a great deal to render the dynamo possible.

THE PERIOD OF THE ALLIANCE MACHINE.

The Alliance machine was originally intended to be used as a source of light by employing, for that purpose, the gases of water decomposed by its continuous currents. This fallacy was soon abandoned, and the machine converted into an alternating current, one to be applied to electric lighting. It was set at work in a lighthouse at Havre, where it is to-day (as one of your committee has seen) doing very good work, never having been out of order from the day it started in 1863.

A host of able inventors then began to develop the dynamo machine. Among these we would call especial attention to one who was far in advance of his time, and anticipator of many recent inventions: Hjorth, of Denmark, who in 1854 55 took out excellent patents, in which the principle of augmenting electric currents by the reaction of electro magnets upon each other, was clearly described; as also the principle of exciting the field-magnets by means of permanent ones.

Werner Siemens, of Berlin, constructed his armature in 1856.

Prof. Holmes, of England, made a machine, which, when approved by Faraday, was used by the British government in an important lighthouse in 1856.

In 1858 an unknown inventor (represented by J H. Johnson, of London) first suggested the auto-exciting principle, which afterwards was independently discovered and presented to the Royal Society by W. Siemens and Wheatstone.

In 1860 a new departure was made in the history of electric lighting, by Antonio Paccinotti, of Italy, who constructed continuous-current dynamo machines (which he also used as motors). In these most remarkable machines all the principles now employed are found. But it is worthy of notice, although attention has never yet been called to the fact, that the auto-exciting capacity of the field-magnets (above referred to) escaped the inventors' observation; and also the action and reaction principle, first observed, we believe, by Fontaine, on accidentally coupling two Gramme machines together.

Wilde (1863), Varley (1866), Wheatstone and Siemens (1867) constructed machines containing the principles of the inventions just referred to, but which were independently discovered by them.

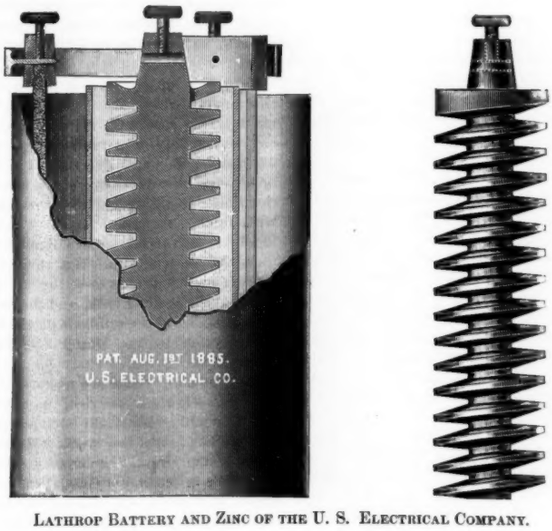
Prof. Rowland, of Baltimore also, about this time (or even before) had devised apparatus containing leading principles.

As your committee only propose to indicate the chief periods of development in the dynamo in its relation to electric light, we must here call especial attention to the machine invented by Z. T. Gramme, of Paris, in 1869.

Although this machine was entirely an original invention, it varied little from that first described by Paccinotti in *Il Nuovo Cimento* in 1863, still its simplicity and efficacy caused an entire revolution in the production of electric light.

In the time which elapsed from the date of its invention to the Paris Exposition (1881) electric lighting became a business, but only by means of the arc light.

However, the possession of so convenient a source of electric power as the dynamo gave a great stimulus to inventors, and several again took up the subject of incandescent lighting. This new enterprise began in Russia, and in the course of a short time Messrs. Lodyguine, Ronn, & Bouleguine, of St. Petersburg, constructed and put in operation, commercially, incandescent lamps with thin carbons, in *vacuo*, contained in glass globes cemented in various ways.



LATHROP BATTERY AND ZINC OF THE U. S. ELECTRICAL COMPANY.

Experiments had also been made with Geissler tubes by Messrs. Benoit who employed them as a source of light for miners' lamps.

It is necessary here to recollect that the invention of the Geissler and the Sprengel mercury pumps; the elaborate and classic studies or Pflucker, Crookes, Gassiot, De la Rive, and others; and the perfection attained by Carre, Gaudoin, etc., in the manufacture of electric light carbons, had paved the way for the successful invention of incandescent and semi-incandescent lamps, and thus enabled Werduman, Jablochkoff, Swan, Edison, and many other inventors, to engage in their manufacture of and perfection; so that at the Paris Exposition, in 1881, it was possible to show lamps that have not undergone much change in form since that day. So much so, that capitalists became convinced that electric lighting had reached a point where they could invest in its development.

THE PARIS EXPOSITION.

This period is memorable for the wonderful impetus given to electric lighting and for the opportunity it afforded to investigate the claims and merits of rival inventors by a comparison of the extensive collections of historic apparatus exhibited. Other expositions, exclusively devoted to electric subjects, were held in London, Vienna, Munich, Philadelphia, and other places, and through their united influence electric lighting has impressed itself upon the business of the age.

THE COMING PERIOD.

Much has yet to be done by discovery, invention, and development before electric lighting will occupy the commanding position it will inevitably assume. In conclusion of this report your committee would call attention to the new fields which are to be explored and to the directions in which what we have is to be developed and perfected.

CENTRAL STATIONS.

The distribution of electric power from central points is going to be the future source of energy, for light and other purposes, in cities. These points will be in the coal, petroleum and gas districts, and in the neighborhood of large water powers. The power which will reach the cities will be stored at central stations or be transformed there for general distribution. Enormously expensive and cumbersome systems of distribution will be abandoned, and currents of high potential must be safely transformed into currents of low potential at the door of the consumer, or, if not needed, be stored for future use. At present central stations employ their capital fruitfully only about six hours in twenty-four. This must be avoided by using the plant when light is not wanted, in storing and distributing currents of different potentials to local transforming centers of consumption by means of more than one system of radial conductors.

TRANSFORMATION OF FUEL DIRECT INTO ELECTRIC LIGHT.

The greatest problem that can now occupy the mind of the electrician is the generation of electricity directly by decomposition of the hydro-carbons, etc., without the intervention of the dynamo. The solution of this problem will simplify the production at the coal fields, etc., and the discovery will reward the one who makes it with untold wealth and honor.

There is an immense field for activity in perfecting and applying thermo-piles, accumulators, potential transformers, Geissler tubes, incandescent lamps, arc lamps, semi-incandescent lamps, meters, gas-engines, etc., to electric-light purposes.

The engineer who applies himself to these subjects has a mine of wealth before him. Let him remember that electric lighting as a business did not exist ten years ago, and let him also recollect that gas lighting is the largest manufacturing industry in the world, and that electric light will be welcomed in every place wherever gas has poisoned and blinded with its fume and flicker.—OTTO C. MOSES, *before the National Electric Light Association, Baltimore.*

The Lathrop Battery.

The two figures shown herewith represent the "Lathrop Primary Galvanic Battery," manufactured by the United States Electrical Company, of this city. In Fig. 1 is shown a sectional view of the battery; Fig. 2 shows the zinc, the screw form of which is a new feature, thus giving a very large surface to the action of the acid. These zincs are self-amalgamating. A little mercury dropped in the pocket at the top, will follow the thread of the screw, keeping the whole zinc bright and lasting. This company report a recent test in incandescent lighting, in which 24 jars, 6 inches wide, 9¼ long, and 8 high, maintained four 16 candle-power lamps for 62½ hours on one charge, being equal to 250 hours on one 16 candle-power lamp.

.... The following gentlemen have been elected directors for the Poughkeepsie District Telegraph Company, for the ensuing year: F. H. Skeel, A. V. Wiltsie, H. S. Acker, E. H. Cook and John M. Pollock. At a subsequent meeting of the directors, these gentlemen were elected officers: President, F. H. Skeel; vice-president, Arthur V. Wiltsie; secretary, H. S. Acker; treasurer, John M. Pollock. In the mes-enger department 5,577 calls were answered from April 1, 1815, to February 17, 1886; and 7,370 telegrams were handled from May 14, 1885, to February 17, 1886. A semi-annual dividend of 1½ per cent. on the capital stock of the company was declared.

Electrical Review.

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We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

Frank M. Gilley, 54 Equitable Building, Boston, Mass., is our New England representative.

Mr. C. C. Haskins, 118 LaSalle Street, Chicago, Ill, will represent the REVIEW in the West.

Messrs. Wm. Dawson & Sons, 121 Cannon Street, London, England, are our representatives for Great Britain.

NEW YORK, MARCH 6, 1886.

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A remarkable explosion which occurred in Germany, shows the force possessed by dust. A sack of flour falling down stairs, opened and scattered the con ents in a cloud through the lower room, where a burning gas flame set fire to the dust, causing an explosion which lifted part of the roof of the mill and broke almost all the windows. This explosion would not have occurred had the incandescent electric lamp been in use instead of the hazardous gas flame.

Mr Wm. D. Sargent, general manager of the New York and New Jersey Telephone Company, leaves this week for Nassau, Bermuda Islands, where he will remain for a month or more, safely "insulated" from telephone calls, underground commissions and maximum rate legislation. His numerous friends will be glad to learn of his return in perfect health thirty days hence. Mr. Sargent is probably the ablest all-round telephone manager in this country; personally popular, he possesses the rare combination of splendid business abilities and expert electrical information, and the REVIEW wishes him abundant success in the endeavor to regain the health and vigor that his unceasing labors in this field have impared.

Dr. C. H. Haskins, the well-known electrician and president of the Wisconsin Telephone Company, has been confined to a sick bed at the hotel Normandie, this city, for a number of weeks. His affliction, rheumatism, has been quite severe, and it was not until last Saturday that he was able to leave for his home. The Doctor received many calls and courtesies from his New York friends while in the city, many of whom, regretting his illness, yet claimed that otherwise his genial presence in New York would not have continued so long. This argument it is difficult to have appreciated by a sufferer from rheumatism; however, we hope Dr. Haskins will visit us soon again, remain longer and enjoy the best of health.

Commissioner of Patents Montgomery in his annual report renews the recommendation of his predecessor that additional room be provided for the Patent Office. He says that every room in the Interior Department building could be advantageously used by the Patent Office. Attention is directed to the faulty sanitary arrangement of the building. A laboratory is an imperative necessity of the office for the testing of electrical apparatus, and a suitable location could be found within the court-yard of the building. The commissioner says the examining corps is wholly insufficient to perform its important duties and an increase of the number of employes is recommended, as well as a general increase in the other divisions The allowances for salaries of assistant examiners are said to be inadequate. It also recommended that the salary of the assistant commissioner be increased from $3,000 to $3,500 per annum.

The decision of the Supreme Court of Indiana, holding that the State has the power to fix maximum rates for rental of telephones, which we publish elsewhere, was an unexpected and serious blow to the telephone interests of the country. There is no disguising this fact, and if this is to be accepted as the law of the land governing the operation of inventions that issue from the patent office, properly signed and sealed, inventive effort has received, if not a death blow, a most disastrous and discouraging repulse. We do not believe the law will stand when carried to the highest courts, but meanwhile its obnoxious features will continue to cripple one of the leading electrical interests. The court in its decision apparently negatives the justice of the law, but nevertheless is able to satisfy itself that it is constitutional. We would advise all our telephone friends to carefully read the opinion, that they may acquaint themselves with this new phase of the telephone business, and know what they must combat in the future.

A PROBLEM IN NATURAL PHILOSOPHY.

The question is often asked why the filament of an incandescent lamp looks, when white-hot, so much larger than when cold. It might be said that the filament or thread or wire of carbon expands when heated, and consequently looks larger because it is really of greater size. Now, the expansion of carbon is very slight, and would not account at all for the apparent increase in size. If, however, we examine the white-hot filament through a piece of glass covered with smoke or steamy vapor, it appears no larger than when cold. When some of the nerve ends of the retina of the eye are excited by light, the excitement extends to some degree to the neighboring nerves. Thus a narrow white-hot wire affects, especially from a distance, more nerve fibers of the retina than really receive the rays of light, and the sensation received is that of a large wire. This phenomenon is called irradiation. The moon, when partly full, appears larger than the part which is dark. A certain degree of accuracy, in judging of the candle-power of a lamp, can be attained by practice in noticing the varying apparent size of the filament when at different heats, and consequently at different candle-powers.

WANTED—AN ELECTRIC CAR-BRAKE.

The accident which befel a freight train of sixty cars at St. Louis, on Friday of last week, and by which a $20,000 loss resulted, is but one in a long list of mishaps of a similar nature which have at last had the effect of opening the eyes of railway managers to the necessity for modern brakes. One naturally enough wonders when he reads of such accidents, why the railroad companies have not long since adopted automatic brakes, which would do so much to prevent their continued recurrence. But the fact is, as any railroad man will tell you, the automatic brake of to-day which renders passenger travel comparatively safe, is altogether too expensive for the fitting of freight trains. It is true that, regardless of expense, some of the more wealthy railroads are now considering the advisability of exchanging the old-style hand-brakes now on their freight-cars, for the automatic type, and that other roads have signified a similar intention as soon as the relative merits and economy of the various descriptions of brakes now in use shall have been ascertained.

Indeed so important has this matter become that the Master Car Builders' Association have announced their intention of instituting a public trial of freight-car brakes at Burlington, Iowa, in July next and another and final one in April, 1887. In other words, immense sums of money are soon to be expended in brakes for freight cars.

Here is a chance for an ingenious and enterprising electrician! The only automatic brakes now in the market which are in any way fitted for the service required, are expensive; so expensive that it is hard to understand how the railroads and transportation lines can afford to fit every freight train with them; though it must be confessed there is reason to believe it will amply repay them in the long run. But the best brake for the money is sure to be the one decided upon at the coming tests, and the one to be recommended to the railroads of the country for adoption by the Master Car Builders' Association.

An automatic brake is a necessity, but, as to this freight-car service, a continuous brake is not. Indeed, in such accidents as that at St. Louis last week, most descriptions of the continuous brakes would have been little better than useless after the train broke in two—which was the cause of the mishap. Hence, it may be laid down as a valuable hint to the electrician that it is an individual brake which is most needed. As a further hint we might suggest—though no doubt he may discover still a better device—that the new electric brake which we hope soon to see appear from some quarter, should be automatically set by the sudden slowing up of the locomotive, and the consequent bumping of the cars the one against the other. In this case there would be no necessity for a continuous wire joining all the cars of a train, and hence in such a case as that at St. Louis, where there was an engine in front of the train and another behind it, a train broken in two would be just as controllable as one that was yet complete and intact.

If a cheap brake could be devised which would go into operation by the pressing together of the buffers of the cars and release the shoes on the axles when the buffers were again released from the pressure, the thing would be accomplished.

Nothing can work as quickly as electricity save thought itself, and no other form of brake could, therefore, hope to prove a rival to an electric one provided the electric brake was not more costly for the efficiency rendered.

Hence we say again: Now is the time for an enterprising electrician to let himself out, and should he be in need of any details as to the coming trials, or of the qualities of the automatic brakes now in use and those most needed in that which the whole railway world is awaiting the appearance of the ELECTRICAL REVIEW stands ready and willing to furnish him with the information.

BOSTON ELECTRICAL NEWS.

The Ball Electric Light Company have just shipped a twenty light (arc) plant for the Tamarack Company copper mine, Lake Superior.

Not long ago Hill, Clark & Co. furnished a Payne automatic cut-off engine to furnish power for a Thomson-Houston arc light plant in South America. The engine gave good satisfaction, and now the same firm have an order for another Payne engine to be sent abroad. It will be used with one of the Thomson-Houston plants which is being installed in Italy.

A car for the "low" style of the Enos Elevated Railroad system is nearly ready for shipment at the shop of Chas. Kibby, Chelsea, Mass. It is expected that the car, which is full size, will be taken to New York for exhibition.

The storm has caused some delay for the telegraph companies. In a number of places in the suburbs of Boston the poles were blown down into the streets.

Mr. Upton, of the Jarvis Engineering Company, intends to take a short trip South.

The Shipman Steam Engine Company will soon put on the market a high-speed automatic engine designed especially for electric lighting. The engine will have a rated capacity of two horse-power. The company have running in their show room a fifteen light incandescent machine.

The Schaefer Electric Light Company are building a new style of Siemens wound dynamos for incandescent lighting. The filaments of carbon for the lamps are prepared in a new and ingenious way which gives high efficiency with lasting qualities.

A dynamo on an entirely new principle, which the inventor claims has passed the experimental stage, will soon be ready for exhibition. It is expected that from five to seven 2,000 candle-power arc lights will be run per horse-power.

Prof. Chas. R. Cross, of the Institute of Technology, has computed for proper size of conductor for a transatlantic telephone cable. The copper conductor should be not less than six inches in diameter, and the insulating covering of the least electrostatic capacity should be two feet thick.

It would appear, from the large number of persons interested in this city in electrical matters, that there ought to be little difficulty in forming an electrical society. Lectures, discussions, exhibition and explanation of new inventions and discoveries would be entertaining and instructive. A reading-room supplied with electrical papers and reference books would be of great value.

For the past few years attention has been paid to the perfecting of systems of electric lighting for large installations. The subject of plants of from five to ten incandescent lights has been very generally overlooked in the attempts to meet the wants of large consumers. The field, however, for plants of small size in large, and in the future small factories, houses, etc., will adopt the incandescent light.

It is now eight years since the subject of elevated railroad was brought prominently to the attention of the people of Boston by the petition of a number of capitalists for a charter for an elevated railroad. The movement was begun by Chas. E. Powers, president of the Middlesex Horse Railroad Company. From the experience obtained in New York city, Mr. Powers saw that the horse railroad companies would be benefited by an elevated or quick transit system; for the surface roads would obtain a large increase in the number of passengers carried short distances, and the short distance travel is exceedingly profitable. The surface roads in the year above mentioned carried about

50,000,000 passengers. Each year since there has been a petition before the General Court for an elevated railroad charter, and the number of passengers carried has increased till it is now in the neighborhood of 100,000,000 per year. In spite of the fact that the horse railroads are under the control of the railroad commissioners and city police, blockades occur almost daily, and it is no uncommon thing for a car to go half a mile in a quarter of an hour in some of the more crowded portions of the city. Public sentiment is strongly in favor of quicker transit and would look favorably on two systems, overhead and surface systems operated by electricity. Cable roads are not in favor with the public, and are looked upon with suspicion by capitalists. The press, which was strongly opposed to any change in the methods of transit, are now outspoken in their demand for better facilities. The president of the South Boston Horse Railroad Company is emphatic in his statement of the objection to the success of a cable road in Boston, and is desirous of a test of the practicability of electricity as a motive power for the street cars. It is probable that something will be done this summer in this direction. So many of the objections to elevated steam railroads are avoided by the use of electric motors, that electricity will be the only power used by a company obtaining a charter from the State Legislature.

BOSTON, March 3.

MR. EDISON ON THE INDIANA TELEPHONE DECISION.

Mr. Thomas A. Edision, in speaking of the decision of the Indiana Supreme Court affirming the constitutionality of the act fixing telephone rates, gives the following pertinent points in opposition to such legislation:

"If that doctrine is to be followed, the Patent Office might as well be shut up, for inventors will not go to the trouble in procuring patents backed up by capital Such a doctrine is fatal to patents and progress. It has proved so in England. In that country an act of Parliament was passed not only fixing the rates, but providing for the purchase of electric-light plants by municipalities at their value without any consideration of the good will. The consequence is that the development of the electric light in England has been stopped—nothing has been done with it since. It is very hard to rai e capital for an invention, and it would be hopeless to attempt to do so if the Legislature steps in and fixes the compensation for the use of the patent. Inventors may as well refrain from getting patents.

"As I understand the patent laws, a patent right is a compact between the people of the United States and the inventor that if he will produce something new and useful they will give him a monopoly of it for seventeen years, and then that they are to have it for all time. So it is with the telephone. If people do not want to pay for the telephone, they need not use it. That Indiana law must be unconstitutional, and I believe will be so declared by the U. S Supreme Court. If the Legislature can fix telephone rates at $3, why not at 10 cents? Where is the limit? I know it is claimed that, as a telephone company is organized by permission of the State, the State has a right to say what shall be charged for telephone service. If this be so, why can't the Legislature say how much a milling corporation shall charge per barrel for flour? The corporation exists under a State charter. And so with regard to cloths made by a corporation."

As soon as electricity is utilized as a cooking power, we can have our meals "charged."

The former offices of the Western Electric Light Company, at 109 Court street, Boston, have been leased by the Chemical Electric Light and Power Company to be used as their factory. This company will occupy at once, with facilities for five thousand gallons of the Volta-Pavia solution per week. The Western Electric Company, of this city and Chicago, will represent the Chemical Company.

ELECTRICAL PROGRESS.

Edi'ors Electrical Review:

The beginning of the present century marked the commencement of an era of important experimental result: Ampere defined magnetism and electricity, in explanation of the fact that a current passed through a wire deflected a magnetic needle; the construction of the electro-magnet soon followed, and at last Prof. Faraday, one of the most noted physicists of our time, devoted the last years of his life to the elucidation of electrical phenomena, resulting in their practical application to the uses of man, to which Doctor Ohm's learned demonstration of electrical law very sensibly contributes.

Inventors of new batteries, ingenious machinery for generating the force, and with schemes of what was then considered the most ridiculously utopian character, were as thick as leaves in Valambrosa; the most ultra of all the ideas promulgated by these inventive geniuses being an electric telegraph and an electric light. Utopian then, important factors now, in the every day life of civilized communities.

It is not my intention in these letters to follow the numerous applications of electricity through its manifold ramifications in the arts and sciences, however congenial to my tastes such an enterprise might be, but it may not be uninteresting before proceeding to a discussion of electric lighting, to glance, if nothing more, at some of the other leading applications of electrical phenomena:

First in order then, and nearly coincident in date with the early demonstrations of the electric force as a luminant, is the electric clegraph. Wheatstone's needle instrument in England, and Morse's sound instruments in America, were patented in the year 1837, and since that time the work of improvement in wire, batteries, and instruments, has never ceased; new industries have been called into being to supply the paraphernalia of electrical operation; submarine telegraphy has sprung into life spanning the ocean with arterial ways through which pulsate messages of weal or woe, potential factors in our intellectual and business growth.

In mechanics the electro-motor threatens to displace horse-power in the movement of our tram cars, and engineers are a ticipating a date, not by any means remote, when electricity will supersede steam, both in navigation, where the coal-bunks occupy a large percentage of avai'able area, and on land in situations where fuel is inaccessible or dear.

In the domain of philosophic research the functions of applied electricity are as wonderful as they are varied. The profession of medicine claims it as a curative agent, and by the aid of the electric light, ingeniously manipulated, the most astounding results have been obtained from the illumination of the interior living human body in aid of the diagnosis of diseases; by the use of electricity, the operation of signal bells and other arrangements of a cognate character.

Railway engineers have been enabled to sensibly lessen the percentage of accident, and to greatly facilitate the movement of trains; and lastly in this rapid review of outlying fields comes the telephone.

There is something weird, and at the same time æsthetically satisfactory, listening through the telephone to the voice of a friend one hundred miles distant, recognizing the inflections of voice, and mannerisms of speech, and to realize his individuality as if present in *propria persona*.

In the busy marts of commerce the telephone has become by habit a necessity, but in the outlying districts of this country, in the fastnesses of the Rocky Mountains, on the plains connecting isolated communities, the telephone has an appreciable value, which the denizens of our cities can hardly be expected to understand.

By its aid the vicissitudes of mountain mining have been greatly ameliorated, and the profitable management of extensive herds of cattle grazing on the western plains rendered possible.

Equal however, if not surpassing in interest all that I have said respecting the beneficent applications of the electric force, is the discovery of the incandescent electric light, the only perfect luminary known to science, perfect in its color, in its diffusiveness, in its intensity, in its grateful softness to the wearied eye, in its absolute capability of regulation, in the non-creation of noxious gases, and its non-interference with a wholesome atmosphere, in its comparative cheapness of production, and its adaptability to all known conditions of interior lighting.

The realization of these conditions, surely entitles me to speak of the incandescent light as a valuable boon to humanity, and to say of the men, who have scorned delights, and lived laborious days in diligent and unwearying quest of a perfect light, many of them gone before, without the joy of ultimate triumph, that they are indeed benefactors of their race, and deserve the grateful appreciation of mankind.

A. C. N. HOWARD.

Salt Lake City, Utah.

A SPECIMEN OF ENGLISH GALL.

The interesting correspondence published below, will explain itself. We doubt very much if the English firm will secure orders from this country for iron poles or any other kind of poles by following the line of policy which requires "concluding a contract for £50,000 or £100,000," before the purchaser knows what he is buying. This method may be "English, you know," but it certainly would not indicate common sense on the part of the purchaser to accede to it.

The correspondence reaches us accompanied by the following pointed letter from Mr. James R. Beard, secretary of the Central and South American Telegraph Company, of 37 and 39 Wall street, this city:

Editors Electrical Review:

Thinking you might like something interesting in the telegraphic line, I inclose you copy of a correspondence with a *telegraph supply* firm of London—Messrs. Bayliss, Jones & Bayliss. I think you will agree with me that for *pertness* their reply to my inquiry "takes the cake." Just imagine a live American company giving an order for £50,000 or £100,000 worth of iron poles, without first obtaining specification and particulars. I don't think such a company exists outside of Sharpe's Broadway railroad corporation, do you?

Yours truly,

JAS. R. BEARD.

The correspondence appears below. The italics in the letter from the English firm we give to call attention to the fact that parties interested in purchases of this kind must "conclude the contract," before they know what they are to receive:

Central and South American Telegraph Co.
New York, January 28, 1886.

MESSRS. BAYLISS, JONES & BAYLISS, 3 Crooked Lane, London—Gentlemen: We learn, through the columns of the *Electrician* of January 15th, that your firm has recently been awarded a large contract for iron telegraph poles for the Indian Telegraph Department.

Will you kindly give us the particulars of this iron pole, length, weight, breaking strain, price per pole complete, F. O. B. in London? Also, the number of wires it can carry. If convenient, please supply us with a drawing of this or any other iron telegraph pole capable of carrying from one to three No. 8 wires.

Very respectfully,

(Signed) JAS. R. BEARD,
Secretary.

139 and 141, Cannon St., London, E. C., February 11th, 1886.

J. R. BEARD, Secretary Central & South American Telegraph Co., 37 & 39, Wall Street, New York—Dear Sir: We are honored with your courteous, valued, and considerate letter of the 28th ult., received here on the 8th instant, and in reply beg to say, that on your *concluding a contract* with us for £50,000 or £100,000 for iron telegraph poles (the same as we have contracted to supply to the India State Government), and opening credit with our bankers—the Bank of England—it will afford us the greatest pleasure, not only to give you "particulars of these poles, length, weight-breaking strain, etc., etc.," but also a carefully prepared model, with details comprising every particular.

Yours, faithfully,

[Signed] BAYLISS, JONES & BAYLISS.

ABOUT MEUCCI, THE ITALIAN TELEPHONE INVENTOR.

In his address at New Orleans in the case of the American Bell Telephone Company *et al. vs.* the National Improved Telephone Company *et al.* in the United States Circuit Court, Mr. J. R. Storrow, of Boston, gave the following interesting account of Meucci and his work:

"Meucci, an Italian, who has lived for thirty-five years in New York, is set up as a prior inventor. He alleges that he invented a speaking telephone in 1849, at Havana, and improved it afterwards, and, in 1872, filed for it a caveat, which is produced, but never patented it because he was too poor. He pretends to support this by a statement that he made a description of it in a newspaper in 1860, fixing the time when the publication took place by the sailing of a friend of his to Italy, the exact date of which we have found by the passenger list. But he says that he has lost the paper and can find no copy of it. He further supports his story (and this is the only thing he has except from memory, for he says that every instrument has been lost) by a memorandum book with dates which begin in May, 1862; an alleged translation of it is produced, but the original is not here.

"The facts about him are, that he made a string telephone, using a wire instead of a string; that he got the silly notion of an ignorant man that by electrifying the wire or the operator he could get better results; and his caveat exactly describes that apparatus and nothing more. According to his story, he had perfect magneto telephones six or seven years before he filed his caveat. The correspondence between himself and his solicitor, produced by the solicitor on cross-examination in a deposition which the Meucci people have recently taken in New York, shows that the caveat does exactly describe all of Meucci's ideas; that it was revised, amended and approved by Meucci in writing at the time; and that he took a caveat and not a patent because he had not made the invention, but had only got a crude idea, never fully worked out to practice, even with regard to the string telephone. He alleges that he was too poor to take a patent from 1858 to 1876; but during that same period he took out more than twenty-five patents, applications and caveats for various inventions. He had behind him some capitalist who furnished more than $125,000 to put in practice some inventions which he had made in paper-making and in candle-making; all of which finally failed. But any of them would quickly enough have furnished means for a speaking telephone, and they all testify that he never mentioned such a subject to them. The Italian newspaper of the period in which he says he published his description has been found, and there is no such description there. At a later period, when he said that he had his most perfect instrument, he did write a publication in a newspaper, and that the complainants have found and put in evidence, and it describes a string telephone, and says that speech is to be transmitted by holding the wire in the teeth. Finally, the memorandum book has proved to be a piece of barefaced forgery. It is an old mercantile book, with some leaves torn out and some of the mercantile writing remaining in it. The lettering on the back of the book and the remaining writing inside show it to have been a book belonging to the firm of Rider & Clark, Rider being one of the capitalists who was connected with Meucci in the way of furnishing means for ten or twenty years after 1858. The mercantile writing in the book relates to the business of the firm by name, and is in the handwriting of Mr. Clark. The entries by Meucci purport to begin and are dated in the spring of 1862. The firm of Rider & Clark did not exist until January, 1863, and was not dissolved until 1866. It is certain, therefore, that Meucci never had that book before 1863, and doubtless never until long after the firm was dissolved and the book became useless to them; and yet he produces it with entries of 1862. [At this point Mr. Beckwith stated to the court that the defense should not rely on the Meucci story."]

Telephonic News

⁂ The telephone company of Pittsburgh has decided to establish a branch exchange in the East End.

⁂ The American National Telephone Company, of New York city, has been incorporated; capital stock, $5,000,000. The incorporators are Theo. Clarkson, Wm. H. Clarkson and Albert M. Bigelow.

⁂ A number of telephones have been ordered by the New Orleans Department of Public Works for the exclusive use of the department. The effect of this will be a prompt attention to a number of complaints, that have heretofore required special messenger service and great loss of time.

⁂ The American Cushman Telephone Company, capital stock $500,000, has been incorporated by Chas. N. Bolden, Geo. W. Hotchkiss and Charles D. F. Smith, of Chicago. Object: To manufacture, use, sell, lease and otherwise dispose of telephone and telegraph instruments and apparatus.

⁂ In his annual report Commissioner Montgomery directs the attention of Congress to the fact that there is at present no statute empowering or directing the Attorney-General to institute proceedings in the name of the United States, or otherwise to cancel or annul a patent which may have been fraudulently obtained or unwisely or inadvertently granted.

⁂ The Cincinnati Council Committee on telegraphs and telephones held a meeting last week, at which were present representatives of the underwriters, telegraph and telephone companies. A report was made by the subcommittee in which they gave a detailed account of the progress of the movement in other cities to secure the burial of all electric wires. A general discussion ensued. The underwriters warmly supported the project, and the telephone and telegraph representatives stated they would gladly support the project if a practical method could be found for laying the wires underground. The matter was finally referred back to the subcommittee with instructions to draft an ordinance and report to the next meeting.

⁂ The new Indiana law has been in force now about seven months, and as there are about 1,000 subscribers to the city exchange, who have paid an excess of $2 a month, the company, if they carry out that agreement, and it is understood that they will, will owe about $14,000 to the subscribers, under the recent decision of the Supreme Court. So far, only one subscriber, a saloon-keeper, has made a demand, and that only informally, upon the company, for a return of the rental in excess of $3.00 per month, which he has paid since the law went into effect. All these matters will be arranged in due time, and he thinks it will be necessary for a settlement to be made with each subscriber, as the collections on toll lines have not been made since then, only by due-bills.

⁂ The report that Edison's house and laboratory were cast away and lost on their ocean voyage to Florida is unfounded. It originated with Edison, who, feeling playful in view of his approaching marriage, telegraphed last week to Gilliland, his partner in Florida schemes: "All our things have gone down. Schooner stove up this side Hatteras. Captain and crew safe." Gilliland somewhat agitated, reported the disaster to the newspapers. Edison corrected him when they met next morning: "Why, Gill, there hasn't been any wreck. You misunderstood me. I only said our things had gone—down South, I meant—Captain and crew are safe, of course; schooner stove up—certainly it was; they would have frozen to death without one up this weather." Then they all had oysters at Gill's expense.

⁂ A Chicago dispatch says: "Aldermen Burnham and Briggs, together with Councilmen Miller, Lowe and Fanning and Daniel F. Hayden, Clerk of the Common Council of Providence, R. I., have been in Chicago for the last two days examining the underground system of wires, with a view of adopting it in Providence. Monday they were in charge of Mayor Harrison, who showed them the elaborate system of city wires, and yesterday Chairman Miller and Mr. Hayden, in company with the representative of the Dorsett Underground Company, the patentees of the underground system, were given an opportunity to examine telegraph, electric light and telephone wires in one conduit, as operated under the Dorsett patent by the Chicago Conduit Company. The committee expressed themselves as being very well satisfied with the system used by the City of Chicago, where more than 1,700 miles of wire are in use under ground. They left last night for Washington to examine the underground system in that city.

⁂ It would be one of the best blessings that electricity has brought to humanity, says a Boston exchange, if a lighthouse like Minot's Ledge, off the entrance to Boston Harbor, could be connected with the shore by a telephone cable. The experiment has been tried in England, and for eight months communication over a ten-mile cable has been successfully carried on. If a line ran to Minot's Ledge, it would be a great boon to mariners and merchants, for the passing of vessels in fair weather and in storm could be noted, ships, after they had left port, could be signaled, if necessary, and when incoming they could signal messages to the merchants, so that preparations to receive the cargo, etc., would be made in advance. In a storm the telephonic communication might prove of inestimable value to property and lives. Here is a chance for Mr. Long to obtain an appropriation and have the experiment tried on Minot's Ledge, that lighthouse being within his district. If successful in England, why not here?

The Statement of the President of the Missouri & Kansas Telephone Co.

To the Stockholders of the Missouri & Kansas Telephone Co.:

We submit herewith the trial balance of our treasurer, C. D. Crandall, for the year 1885, and I take the following figures for your information:

On Jan. 1, 1886, we had 3026 subscribers.	
On Jan. 1, 1885, we had 2559 "	
Making on increase of 467 "	
Or a gain of about 18 per cent.	
Our debt on Jan. 1, 1885, was	$33,922.61
Our debt on Dec. 31, 1885, was	2,572.82
Being a decrease of	$31,349.79
The interest on the debt for 1885 was	$898.09
During the year we have built 97½ miles of toll lines at a cost of	$ 5,853.93
Expenses of construction at Kansas City	24,059.42
Expenses of construction at Leavenworth	2,251.01
Expenses of construction at St. Joseph	2,359,01
Expenses of construction at Topeka	1,984 81
Expenses of construction at other exchanges	3,029.35
Total expense of construction	$ 9,487.53

The average cost of construction for each subscriber added, based upon the net increase of subscribers, is $72.

We have a total mileage of toll lines of 371 miles, against 203 miles for 1883, and 278 miles for 1884.

We closed during the year, the exchanges at Mexico, Moberly and Sedalia, as the financial condition of the country was such that they could only be run at a loss; but with the revival of business, and the subsidence of railroad strikes, we have re-built and re-opened the exchange at Sedalia, Mo., as of date of January 1, 1886, under very favorable circumstances and with an increased patronage that insures profit.

Kansas City continues to give us the greater part of our growth and at the same time absorbs the larger portion of our construction account. We anticipate a continual demand for money for this growing point.

Our plant has never been in better condition. We are gratified to announce that the company is out of debt, and that the net earnings for the last four months of 1885 averaged over $7,000 per month; and for the present year we hope to earn a sum sufficient to pay a cash dividend of five per cent. out of the earnings, and to have a sufficient sum left to make any needed extensions that will offer adequate promise.

Among the needs will be a toll line from Kansas City to Ottawa, *via* Olathe; another line from Kansas City to Topeka; and another line from Topeka westward to Manhattan, *via* Rossville, St. Mary's and Wamego. Our company must keep abreast with the growth of our territory.

We are pleased to report that our service is not to be excelled, and that universal satisfaction is expressed by our patrons.

This company has paid no dividends since July 1, 1883, all the net earnings having gone to extensions and betterment of plant. There has been $136,210.49 of net earnings expended for these purposes.

As telephone plant is short lived, and as no fixed sum has been charged off in the past to equalize the depreciation of your property, I would recommend that the balance of these net earnings, to January 1, 1886, be charged off, and that hereafter a fixed percentage be appropriated for that purpose.

The percentage of expense to earnings, was 57 per cent, a decrease of 7 per cent. from that of 1884, or a proportionate decrease of over $11,600.

I cannot say too much in commendation of the able assistance rendered me by the officers and employes of the company, and to them I cheerfully credit the happy results of the year 1885.

Herewith I give you our treasurer's trial balance of December 31, 1885; also his statement of our earnings and expenses during the year.

SUMMARY FOR TRIAL BALANCE FOR 1885.

License and right-of-way	$ 648,787.78
Construction	372,450.54
Bells	28,783.25
Merchandise	1,313.54
Personal property	2,184.11
Stock and bonds	80,000.00
Accounts receivable	4,803.26
Cash	4,260.60
Total	$1,142,583 08
Capital	$1,000,000 00
Surplus	64,286.90
Reserve	500.00
Toll tickets, outstanding	3,299.77
Accounts payable	2,572.82
Profit and loss	71,923.59
Total	$1,142,583.08

Respectfully submitted.

J. R. MULVANE, Pres't.

— The controlling interest in the Shamokin Gas Light Company, of Shamokin, Pa., has been sold to the local electric lighting company of the town. What was the price paid we are not informed. The original capital of the company was $25,000. This was raised, not long since, to $45,000. The system employed by the electric lighting company is the incandescent. Shamokin is a flourishing and growing town of over 14,000 inhabitants.

That Indiana Decision.

FULL TEXT OF THE OPINION OF THE COURT IN THE TELEPHONE CASE.

The decision of the Supreme Court, of Indiana, in the case involving the constitutionality of the legislative act limiting the rental of telephone sets to $3.00 per month, was given February 20, in favor of the law. It is understood that the telephone company will appeal to the Supreme Court of the United States, but it will be several days before it is known what the company will do in regard to present service—whether it will withdraw its service from the city entirely, or give a service at a decided loss under the terms of the law.

The court first quotes the provisions of the act and then proceeds as follows:

"On the 27th day of July, 1885, Theodore P. Haughey requested the Central Union Telephone Company, a corporation organized under the laws of the State of Illinois, but owning and operating a telephone exchange and system of telephone lines at the city of Indianapolis, in this State, to rent him one telephone to be used at his residence upon his farm four and one-half miles from the company's telephone exchange and two miles outside of the corporate limits of the city of Indianapolis, and to connect such telephone with the exchange by the erection of the necessary poles and wires. In response to this request the company offered to rent to Haughey a hand telephone and magneto-bell, and to connect them with its exchange, and to furnish exchange service from 7 o'clock A. M. until 6 o'clock P. M. each day, for $3 per month, the company to have the right to place other subscribers upon the same line. But Haughey declined to accept that offer, and instead entered into a contract with the company for the use of one battery transmitter and one magneto-telephone and the necessary appliances for connecting them with the exchange, upon certain terms and conditions named in the contract, for which he agreed to pay the sum of $33.50 for each quarter, or $11.16 2-3 per month. The contract says: The above total sum is based upon the charges itemized as follows:

Rental of one magneto-telephone and battery transmitter (two telephones), at the rate of, per annum	$ 20
Labor and service charges for switching, construction and maintenance charges for lines, batteries, central office apparatus, magneto bell and other appurtenances, at the rate of	114

"The telephone company built the line and furnished the equipments for the use of Haughey, called for by its contract with him. At the expiration of the first three months after the contract went into effect the appellant, John E. Hockett, acting as the district superintendent and general agent of the company at Indianapolis, demanded of, and received from, Haughey the sum of $33.50, claimed to be due under the contract for the latter's use of the line and equipments therein provided for during the preceding three months. An information was thereupon filed against Hockett, charging him with a violation of the provisions of the act of the Legislature, and upon proof of the matters above stated, with others of a formal, incidental or a merely collateral character, the court below found him guilty of having charged more for the use of a telephone than the law permitted him to do, as well as the company he represented, and, after overruling a motion for a new trial, adjudged that he pay a fine as a penalty for the commission of a criminal offense.

"It was shown at the trial that the articles furnished for Haughey as a telephone equipment, as well as the other mechanical contrivances used by the company in the transmission of words and sounds over its wires, are patented articles, and that the company holds the right to use these patented articles by assignment, either direct or remote, from the patentees. It is first and most earnestly contended that, as the articles used by the company, as above stated, are patented under the Constitution and laws of the United States, the legislature of a State has no

power to limit the price, use, sale or rental value of such articles, and that, as a consequence, all acts of a State Legislature of the class to which the one before us belongs, are inoperative, and ineffectual for any practical purpose. Conceding the force, as well as the plausibility, of many of the arguments and illustrations used by counsel, the ready and, indeed, inevitable answer is that the question thus presented ought no longer to be regarded as an open question. There is a reserved and, at the same time, well-recognized power, affecting their domestic concerns, remaining in all the States which the Government of the United States cannot and has seldom attempted to invade. This power is so varied and comprehensive that an exact definition, as applicable to all its phases, has so far been found to be impracticable, but the instances in which the existence of such a power has been judicially recognized in particular cases are quite numerous, as well as various in their application to our complex system of government. [Numerous citations in support of this appear here.] While, therefore, it is true that letters patent confer upon the patentee a monopoly to the extent of vesting in him, his heirs and assigns the exclusive right to make, use and vend the tangible property brought into existence by a practical application of the discovery covered by letters patent, for a limited time, it is not true that such right authorizes the making, using or vending such tangible property in a manner which would be unlawful, except for such letters patent, and independently of State legislation and State control.

"It is next contended that the Central Union Telephone Company was organized, and has so far been conducted as an ordinary business investment, and is in its methods, as well as in its relations to its patrons and subscribers, a merely private enterprise, no more subject to legislative control than any other private business, with which a considerable number of persons has become either directly or indirectly connected; that consequently the act of the Legislature, under which the prosecution was instituted, is inoperative and void as a restraint upon the company in its charges for the rental and use of its instruments.

"The telephone is one of the remarkable productions of the present century, and, although its discovery has been of recent date, it has been in use long enough to have attained well-defined relations to the general public. It has become as much a matter of public convenience and of public necessity as was the stage coach and sailing-vessel a hundred years ago, or as the steamboat, the railroad and the telegraph have become in later years. It has already become an important instrument of commerce. No other known device can supply the extraordinary facilities which it affords. It may, therefore, be regarded, when relatively considered, as an indispensable instrument of commerce. The relations which it has assumed towards the public make it a common carrier of news, a common carrier in the sense in which the telegraph is a common carrier, and impose upon it certain well-defined obligations of a public character. All the instruments and appliances used by a telephone company in the prosecution of its business are consequently, in legal contemplation, devoted to a public use.

"It is now a well settled legal proposition that property thus devoted to a public use becomes a legitimate subject of legislative regulation and control. [Numerous citations are here given.]

"The obvious deduction from what has been said, as well as from the authorities cited, is that the power of a State Legislature to prescribe the maximum charges which a telephone company may make for services rendered, facilities afforded, or articles of property furnished for use in its business is complete.

"It was made to appear by the evidence that there are several instruments, more or less, in use by telephone companies, each known as a telephone—one as the hand telephone, another as the box telephone, a third as the switchman's head telephone, and the fourth as the battery transmitting telephone; that the first, known also as the Bell hand or magneto-telephone, consists of a bar magnet, with a helix of wire at one end, a diaphragm suitably mounted in front of a helix, and a hard rubber case supporting the whole, with combined poles for making connection with a cord from twenty-four to thirty inches long, and through it with a magneto-bell; that this telephone will both transmit and receive sounds or words carried electrically over a connecting wire; that this instrument was at first, with the assistance of the magneto, used in transmitting, as well as in receiving telephonic messages; that some time after this Bell hand telephone had thus come into use, the battery transmitting telephone, known as the Blake transmitter, was introduced and generally accepted as a very decided improvement in the transmission of words and sounds over wires used by telephone companies, words and sounds being transmitted through it in a louder tone, and with greater effect, than through the Bell hand telephones; that for some time previous to the 13th day of April, 1885, this Blake transmitter had come into general use in the transmission of messages with that class of patrons, and subscribers who desired the best available telephonic service; that since the Blake transmitter had come into general use, as stated, the Bell hand telephone had been chiefly used as a receiver of messages, only a comparatively few persons continuing to use it also for transmitting purposes; that on the day last-named, and for a considerable time previously, a fully-equipped organization for the convenient and ready transmission and reception of messages over telephonic wires, consisted, as it still consists, of a Bell hand telephone and cord, a Blake transmitter, a magneto or call-bell, a cell battery, a back board and a battery box; that the instruments thus constituting a telephone equipment have been and still are only rented by telephone companies to their patrons and subscribers, the latter not being allowed to either purchase or own any of such instruments. Upon the facts thus disclosed by the evidence, it is, in the third place, contended that the act of April 13, 1885, under consideration, only limits the price to be charged to $3 per month when one instrument known as a telephone is rented to a patron or subscriber, and does not apply to a case like the one before us, where two instruments, each answering to that name are, for his greater convenience, rented to the same person to be used together, and that consequently the facts of this case do not bring it within the several provisions of that act. In a general sense, the name telephone applies to any instrument or apparatus which transmits sound beyond the limits of ordinary audibility. The speaking tube used in conveying from one room to another in large buildings, on a stretched cord or wire, attached to arbitrary membranes or disks by which the sound is carried to a distant point, is, strictly speaking, a telephone. But, since the recent discoveries in telephony, the name is technically and primarily restricted to an instrument or device which transmits sounds by means of electricity and wires, similar to the telegraphic wires. In a secondary sense, however, being the sense in which it is most commonly understood, the word telephone constitutes a generic term having reference generally to the art of telephony as an institution, but more particularly to the apparatus as an entirety, ordinarily used in the transmission, as well as in the reception of telephonic messages. In this latter sense the Central Union Telephone Company, in behalf of which the appellant stands as the representative in this proceeding, has very significantly sanctioned the use of the word telephone. In August, 1885, it published a book for the use of its patrons and subscribers, entitled 'Indianapolis Telephone Directory,' in which those having the use of the telephone instruments were instructed as follows: 'Call by numbers; when through talking, ring out; make all complaint to the chief operator—call No. 1,000; help each other by answering your telephone promptly; do not allow non-subscribers to use your telephone; it is unjust to other subscribers, impedes the service, and is a violation of your contract.' These were a substantial repetition of the instructions issued by the Western Telephone Company, one of the predecessors of the Central Union Telephone Company, in June, 1883. In these instructions the telephone is plainly referred to as an organized apparatus—an institution—and not as a single instrument. In this use of the word 'telephone' the telephone companies in question simply adopted and emphasized what had already been generally accepted as the proper meaning of that word in the connection in which it was so used by them.

"Before the great discovery of Prof. Morse in telegraphy, the power of electricity to give a sudden and mysterious impulse to a suspended wire was well understood among those most familiar with experiments in electrical science. His discovery consisted in the invention of an instrument or machine which utilized that power of electricity, and thereby enabled him to send intelligible messages over suspended wires to remotely distant places. When that instrument or machine first came into use, the word telegraph was understood to more particularly refer to it, but since since that time a much wider and more comprehensive meaning has been attached to that word, as the thing best known by that name. The 'telegraph' is now usually accepted, and in common parlance is generally understood, as referring to the entire system of appliances used in the transmission of telegraphic messages by electricity consisting of (1) a battery or other source of electric power; (2), a line wire or conductor for conveying the electric current from one station to another; (3), the apparatus for transmitting, interrupting, and, if necessary, reversing the electric current at pleasure; and (4), the indicator or signaling instrument. [See Imperial Dictionary, title 'Telegraph.'] In the respect indicated, the varying meanings of the word 'telephone' are analogous to those applied to the word 'telegraph,' there being very much in common between the two systems of telephony and telegraphy. In reaching a conclusion as to what is generally understood by the use of the word 'telephone,' we have been governed partly by the information judicially within our reach, and in other respects by the evidence. The word having become a term of art, evidence was admissible to explain its proper meaning. In view of the condition of things, as shown to have existed on the 13th day of April, 1885, we feel constrained to hold that the word 'telephone,' as used in the act of that date, was intended to designate, and, in fact, really referred to an apparatus composed of all the usual and necessary instruments for the convenient and ready transmission and reception of telephonic messages, and not to a single instrument only.

"There was evidence at the trial tending to prove that the Central Union Telephone Company cannot supply the facilities to Haughey provided for in its contract with him for $3 per month without actual and very serious loss, and, arguing that the Legislature cannot be presumed to have intended to inflict injustice upon any person or corporation, it is insisted we ought to take the company's liability to sustain a great loss in a certain contingency into consideration in determining the legislative intention in enacting the statute in question in this case. This argument is largely based upon the assumption that the company was not at liberty to decline to extend its line to Haughey's farm upon his request that such an extension should be made, and that it will be compelled to maintain such extension so long as Haughey may require it to be maintained, independently of any contract with him on the subject. This assumption is, however, not well founded. There is nothing in the act of the Legislature under review, or contained in any other statutory or common-law regulation applicable to the subject to which our attention has been called, which requires a telephone company to construct a new line against its will or to maintain an old line longer than it may feel, in the exercise of legitimate business discretion, inclined to do so. Besides the power of the Legislature to pass the act in question being conceded, this court cannot sit in judgment upon either the justice or the expediency of the enactment of such a law. If the law shall prove to be either unjust or inexpedient in its operation, whether upon persons or corporations, the appeal must be made to the Legislature and not to the courts.

"The judgment is affirmed, with costs."

TELEGRAPHIC

.... China has 3,500 miles of telegraph line, and only seven miles of railroad.

.... The great wind storm in the Eastern States last week blew down a great many wires, and caused more delay in telegraphic circles than ever occurred, in all probability, from the same cause before.

.... It is reported in Washington that the telephone suit will be brought in Columbus, Ohio. Also, that Hon. A. G. Thurman will succeed Attorney-General Garland—all on account of the telephone.

.... The Electric Reporting Company of Pennsylvania, of Philadelphia, with a capital stock of $5,000 has been chartered. The company is organized for the purpose of serving financial and general news and market quotations of stocks, oil, grains, etc., by telegraph in Philadelphia, Pittsburgh, and Oil City and Bradford. The directors are George W. Wakefield, William H. Smith, Jr., Charles A. Lang, Charles J. Lauderbach, and Thomas H. Heller, of Philadelphia.

.... A firm which makes a specialty of the erection of shafting, states that its experience teaches that the loss of power due to improper conditions in the line shafting amounts to fifty per cent. of the engine power employed, and that the defects most commonly found are as follows: Shafting too light for the duty, crooked shafting, hangers too far apart, hangers bearing too short, pulleys too heavy and not properly balanced, hangers which are not adjustable and not self-adjusting and sometimes filled with spurious babbitt metal, and improper proportion between two pulleys connected by the same belt.

.... Mr. Junius Lynch Clemmons claims that he invented the electric telegraph in 1835, while at Randolph-Macon College, Virginia. He states in an interview that he communicated his discovery to a Mr. Page, who was in the Patent Office, and who had become quite eminent as an electrician. Page did not answer the letter and eleven years after took out a patent on the discovery, and associated Morse and Amos Kendall with him. The company applied to Congress for aid to develop the discovery, and the world knows the result. Clemmons claims only the original invention, but gives Morse credit for its development. He concludes the interview as follows: "I would not pluck a single leaf from the laurel that circles Morse's brow or drop a word that would reflect upon his memory." The letter is published as a vindication of the truth of history!

.... A legal contest has been started between the State of Pennsylvania and the Western Union Telegraph Company, that is likely to become very much complicated, and very interesting, before it is concluded. The contest is similar to the one that was recently waged between the telegraph company and the State of New York, in which the latter was awarded a verdict for taxes which were due, and the payment of which the company evaded for a long time. The claim the State of Pennsylvania now has against the company is for taxes on the gross receipts, which have only partially been paid heretofore. The total amount that is claimed to be still due the State, is $130,000. The case is now before the Board of Public Accounts, which is composed of Auditor-General Niles, Attorney-General Cassidy and State Treasurer Livsey. The re-settlement of all tax accounts comes before this board. The board is now considering this matter, and when it orders the re-settlement to be made, the Western Union company will have an opportunity to appeal from its decision to the Court of Common Pleas of this county. That this appeal will be taken is almost certain, and then will begin a long contest in the courts, which, it is expected, will lead to some interesting developments.

ELECTRICAL AND SCIENTIFIC

* * Mr. J. D. Sisson, of Worcester, Mass., has patented an electrical device which will indicate any waste of water through the supply-pipes.

* * The Appleton Electric Street Railway Company, Appleton, Wis., has been incorporated with a capital stock of $35,000. J. E. Harriman and others are the incorporators.

* * The tennis club of Salt Lake City has rented the skating rink, and plays at night by the aid of the electric light. The Mormons evidently know how to appreciate a good thing.

* * A dispatch from Fort Monroe, Va., says: The United States steamship Tallapoosa arrived from Washington this morning. The electric-steering apparatus worked admirably. She sailed for Newport at noon.

* * At no time in the history of the city of Chattanooga, Tenn., was there such a boom as now in the iron mills. Four leading mills are running night and day, and are behind with their orders. The Roane Iron Works are proposing to erect a steel plant and furnaces, and will resume with 600 hands.

* * A Philadelphia gentleman claims the invention of a new plan of electro-pneumatic transit, which is designed to carry letters and packages from city to city at a rate of nine miles a minute. The tube will be of brass, incased in iron, through which a close-fitting metallic carriage containing the articles will be projected by a volume of compressed air. Intermediate cities and towns will have tubes connecting with the main tube, and the destination of the carriage will be under the control of the operator at the main office, who will manipulate the switches by electricity, and thus be enabled to send the carriage to any desired point.

* * A much abused keeper of a toll bridge is in sore distress. He tells his story in these words: "Well, you see I had charge of a bridge not far from here. The owners are very particular about receiving every cent that is due them, so they put in one of those registers. It is a sort of fool electric arrangement sunk in the foot passageway of the bridge, and makes a mark with a clicking punch every time anybody steps on it. Well, everything was all right until the other day. A big Newfoundland dog got on the blamed thing and began to scratch himself, and, sir, before I noticed him he had charged me up $275. Yes, I am a ruined man."

* * Considerable attention has been lately directed to the commercial and industrial value, at least prospectively, of the tupelo gum and willow oak timbers of Mississippi. After various and thorough tests, the first-named has been pronounced almost as soft and light as cork, and the whitest timber in the valley. It is extremely light, cannot be split, while at the same time it is very tough, tenacious, and will bear a heavy strain, its various qualities rendering it specially valuable for buckets, pitchers, trays, ox yokes, and almost all kinds of water vessels, as well as for many other purposes. The water or willow oak is said to be second only to the live oak, is almost as hard when seasoned as is the latter, and for the rim and spokes of wheels is alleged to have no superior, while for shipbuilding it will almost equal the live oak in its firmness and durability. Tests have been made of the crushing capacity of this wood, and also of its transverse strength, with remarkably favorable results, the published data showing that it is one-third stronger than any white, red or black oak, and only one-eighteenth less than live oak.

The Practical Gauging of Voltmeters.

It is known that measuring apparatus very rarely give concordant indications, says M. G. Rouy, in *L'Electricien*. This depends on initial errors in gauging, on the weakening of the magnets, and on molecular changes in the springs or on other causes. Hence follows the necessity for frequently regauging measuring apparatus.

We shall concern ourselves here merely with the gauging of voltmeters, that of ampere-meters having been already considered (*L'Electricien*, August 8th, 1885, No. 181, p. 529). The following is a method easily carried out with the same apparatus as those necessary for gauging ampere-meters:

Let us suppose that the apparatus in question is a voltmeter intended for measuring differences of potential not exceeding 20 volts—a convenient range sufficient for amateurs who wish to know the difference of potential at the extremities of their batteries, or of the lamps of a private lighting installation. We arrange in circuit the standard, the resistance box and the galvanometer with its shunt. Let us take, *e. g.*, as standard, a Daniell element, where the zinc is immersed in a solution of sulphate of zinc, half saturated. The electromotive force of such an element is 1.07 legal volt, and a Deprez-d'Arsonval galvanometer with a movable coil having, for instance, a resistance of 150 ohms. We regulate the resistance of the box and that of the shunt so as to give the galvanometer 100 divisions per volt. Let the resistance of the box be 1,000 ohms, and that of the shunt 10. With 20 volts we should, therefore, have 2,000 divisions; but if we render the total resistance of the circuit 10 times greater by putting 10,090 ohms in the box, we shall have 200 divisions to 20 volts, or 10 divisions per volt; we can then appreciate exactly the tenth of a volt. We arrange, then, in the circuit a battery, the electromotive force of which is at least = 20 volts, and a rheostat for varying the difference of the potential at the extremities of the battery. We then measure simultaneously this difference of potential with the voltmeter to be calibrated and with the graduated galvanometer, and verify thus the exactitude of each point of the graduation.

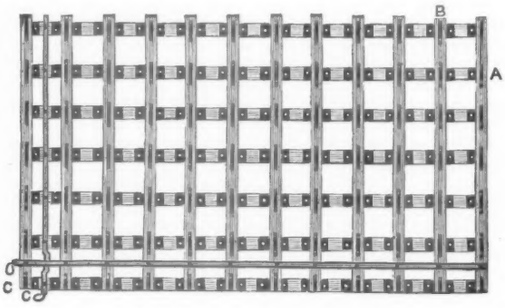
Let us suppose, now, that we wish to recalibrate a voltmeter of 60 volts like those used for measuring the difference of potential at the extremities of arc lamps. We regulate the Deprez-d'Arsonval galvanometer so as to give two divisions per volt; therefore, as before, we had 100 divisions per volt, we render its sensibility 50 times smaller by multiplying the resistance of the box by 50. We then arrange in series the elements of the battery (Daniell, Leclanche or accumulators) in such a number that the electromotive force may be at least equal to 60 volts; and by means of two loose wires we take the difference of potential at the extremities of 1, 2 . . . . *n* elements successively with the voltmeter and the galvanometer.

If in the place of a voltmeter of 60 volts we have one of 110 volts, such as those used in the Edison system of distributing electric energy, we operate in a similar manner, acting on the resistance and the shunt of the galvanometer, so as to have only one division per volt.

We may easily obtain the potentials necessary for graduating these apparatus by means of Plante's battery; 30 small accumulators mounted on the same stand may be connected in series or in quantity by the aid of a commutator. They are charged in quantity and then connected in series, and by means of loose wires a variable number of them are arranged in circuit with the voltmeter and the graduated galvanometer.

An Electric Mat.

The cut on this page represents the new alarm electric mat of Brown & Brown, 106 and 108 Liberty street, of this city. The brass strips, *A*, cross the brass strips, *B*, and are kept apart at the intersection by pieces of rubber. The slightest pressure makes the connection and sets off the alarm. The mat can be placed under the carpets or rugs, in front of the windows, doors, at foot of stairways, and in the vicinity where valuables are kept. It can be connected with an alarm in any part of the house desired, or outside of the same. It affords a positive security from burglars, sneak thieves and tramps and is easily disconnected when not in use. The alarm can be either continuous or a single stroke, and can be used to advantage in connection with other burglar alarms in use, especially when it is desired to open windows and doors in warm weather. It is invaluable to storekeepers, to be placed in front of doors to announce customers, or in front of money drawers.



ELECTRIC MAT OF BROWN & BROWN.

That Indiana Telephone Decision.

The Cincinnati *Evening Telegram* makes the following pointed remarks for the benefit of Indiana law: "The Supreme Court of Indiana has made a remarkable decision that the State can declare by law, that the telephone companies shall not charge more than $3 per month for the use of telephone instruments. Why would it not be in order to fix the fees of the lawyers by law? Why would it not be in order to fix the charges that surgeons and doctors may make by law? Why not do as the King of France once did, decree that the price of bread shall not exceed so many cents per loaf? If the price of bread was fixed at relatively the same amount that telephone charges are fixed at in Indiana it would not exceed 3 cents for the ordinary sized loaf. It may be that a telephone at $8.33 per month, as we pay in Cincinnati, is too high, but we seriously doubt that a candid, honest and careful examination of the business would cause any capitalist to invest his money in it if the rates were reduced to twice the amount that is allowed to be charged by law in Indiana. However, on reflection we are in favor of reducing the price of things we have to buy, by law. In the first place, we desire that the price of pink paper be reduced (and particularly that on which the *Telegram* is printed) to two and one-half cents per pound. We shall also insist that our electric light be furnished to us at $10 per month, instead of $20, and in order to allow the general public to share with us in the blessings that we are asking, we shall have a bill prepared to compel the reducing of rents from the figures at present paid to one-half that amount. With rents reduced to one-half and bread brought down to 3 cents per loaf, we do not see why there should not be universal happiness reigning. Hurrah for Indiana and her communistic tendencies. We distinctly want it understood, however, that in no event must the price of advertising be reduced, nor the retail price of this paper be interfered with. We will, however, support a bill that will compel the *Enquirer* and *Commercial Gazette* to be sold for two cents per copy.

"It stands to reason that if the *Telegram* sells for a cent per copy, which every one will admit is the better paper, there is no reason why Halstead and McLean should be allowed to cabbage five cents for each copy of their morning swindles.

"We thank you, Indiana, for the suggestion you give us."

New Solution for Electro-deposition of Metals.*

BY G. GORE, LL.D., F.R.S.

The liquid employed was an aqueous solution of asparagine. It was not quite saturated, and consisted of about .88 gramme of crystals of the substance, dissolved in 18. cc. of distilled water. The solution was faintly acid to test-paper, and was used at a temperature of about 70° C. Portions of this liquid were more or less saturated with different metallic oxides, and the resulting solutions electrolyzed by currents from one to six voltaic couples, consisting of zinc and platinum in dilute sulphuric acid. The electrodes had usually one square centimeter of surface on each side.

Experiment 1.—.23 gramme of hydrated oxide of cadmium was mixed with about 20. cc. of the liquid; it did not all dissolve, and the solution was feebly alkaline. The mixture was electrolysed with an anode of cadmium and a cathode of copper. Adherent, white, reguline deposits of cadmium were easily obtained; no gas was set free at either electrode, and the anode remained clean and bright.

Experiment 2.—.28 gramme of zinc oxide was added to about 23. cc. of the liquid; the latter became alkaline. With a zinc anode and copper cathode, and a current from six cells, a moderately good deposit of metal was produced. No gas was evolved.

Experiment 3.—By using calcined magnesia in place of oxide of zinc, a current from six cells, and a magnesium anode, a film only was deposited upon the copper cathode, and that film evolved gas distinctly when wetted with dilute sulphuric acid. The amount of deposit was not increased by using a larger anode, a smaller cathode, and a more concentrated solution. Much gas was then evolved at each electrode. The mixture was alkaline to test-paper.

Experiment 4.—.9 gramme of cupric oxide was partly dissolved to a blue liquid in 23. cc. of the solvent. With a copper anode and platinum cathode, a small amount of reguline metal was deposited by a current from six cells. Addition of a little ammonia to the solution decreased considerably the conduction resistance, but caused evolution of gas at the cathode during passage of the current, and the deposited metal to be soft and of a dark color.

Experiment 5.—.1 gramme of dark red mercurous oxide was mixed with 21. cc. of the liquid. With electrodes of sheet platinum, a small amount only of mercury was deposited by the current from six cells. No gas was evolved. With yellow mercurous oxide the results were similar.

Experiment 6.—.33 gramme of oxide of silver was added to about 20. cc. of the asparagine liquid; the latter became feebly alkaline. With an anode of silver and a cathode of platinum, and a current from one, two, or four cells, good deposits of white reguline silver were obtained. No gas was set free.

Cyanide of silver was insoluble in a hot solution of asparagine.

* Read before the Birmingham Philosophical Society, Jan. 21, 1886.

Mr. Sheridan's Opinion of Crampton & Co.'s Manner of Doing Business.

Editors Electrical Review:

Yours of the 4th received in due time, in which I find you were so kind as to see Messrs Crampton & Co., 34 Broadway, relative to the Reis instruments which I ordered from them and paid them the price, $3, but up to the present I have not, nor do I ever expect to receive either the cash or instruments. Whilst thanking you for your courtesy in making the necessary enquiry as to the firm I now beg to say that I have not received the instruments, and think that your readers should be warned against such a firm. I merely wanted the instruments to have as a curiosity, so I do not lose much except the $3, being able to construct them myself.

Yours truly, HENRY SHERIDAN.

Chicago, Feb. 12th, 1886.

The Electric Arc.

Editors Electrical Review:

With the view of demonstrating that the vaporization of the positive electrode was essential to the production of the electric arc, the writer tried an experiment some time since which may interest others.

A disk of sheet copper, about 5¾ inches diameter, was placed in a lathe, and rotated at a speed of about three thousand revolutions per minute, the lathe being connected to the positive pole of a dynamo and the negative wire placed against the periphery of the disk, water being also applied to the disk by means of a moist sponge held against it.

It was observed that at times there would be a failure to obtain an arc by removing the negative wire; but this may have been due to an interposed failure of water, for without the water an arc was apparently formed, although the conditions under which the experiment was performed rendered it impossible to be certain that it was not merely a rapid succession of contacts, producing sparks.

It is suggested to those having facilities for the experiment that two large disks, rolling against each other at a high speed, would be preferable, as the rubbing contact, which causes considerable heat at a high speed, would be thus avoided.

Owing to its higher specific heat, iron might be preferable to copper.

WM. B. COOPER.

PHILA., Feb. 26th, 1886.

Electrical Conductivity of Air Under Reduced Pressure.

Experiments, by T. Homen, on the relation of the conductivity of air to the pressure, have led to the opposed conclusions that an absolute vacuum is a perfect non-conductor, and a good conductor of electricity. In this paper, an elaborate series of experiments on the conductivity of air in discharge tubes under various degrees of pressure are described. The results show that the phenomena of conductivity of air under reduced pressure are of two kinds, the one, the particular resistance of the air, which is proportional to the distance between the electrodes, the other the actual resistance of the electrodes themselves. The former is independent of the diameter of the air column, and its increase is nearly proportional to the pressure, whilst the latter increases very quickly with decrease of pressure, and under low pressures reaches a point at which the resistance is such that electricity, even at the highest difference of potential, cannot overcome it. These results are not in accordance with the view that a vacuum is a good conductor of electricity.—*Ann. Phys. Chem.*

Trade Secrets are Private Property.

Chancellor Runyan has decided a case at Trenton, N. J., which is of unusual importance and general interest on account of the peculiar relief sought from the court. The court is asked to restrain a man from divulging a secret. The complainant, Rudolph G. Solomon, of Newark, claims to have discovered valuable secrets in connection with the manufacture of cordovan leather and for coloring kangaroo, alligator, and snake skins. He has been engaged in the business about eight years, and employed his bookkeeper and superintendent, Hertz and Adolphi, with the understanding that they were not to divulge the secrets of the business. Hertz and Adolphi, after learning his methods, made arrangements with two strangers to go into business and compete with Solomon. "That the facts set up in the bill entitled the complainant to relief admits of no question," says the chancellor: "A discoverer of a process of manufacture, whether patentable or not, has property therein. The case is simply upon the bill and answer, and, although the defendants deny the facts set up in the bill, if the injunction be dissolved the secrets would become known, and an irreparable injury be done the complainant." The defendants were restrained from using the secret processes of which the complainant is the discoverer.

New Electric Light Station of the St. Paul (Minn.) Gas Light Company (Operating the Fuller System).

Through the courtesy of Mr. Gilbert Donaldson, manager of the electric-light plant operated by the above company, your correspondent was shown through their fine new station, a brief description of which cannot fail to interest your readers.

The building, which is of stone, with 2½ feet walls, is centrally located between the upper and lower towns on a lot 120 x 200 feet, near the tracks of the Milwaukee and St Paul and Omaha railroads, by which it is connected with switches. The first story, 20 feet high × 40 × 175 feet, is occupied principally as follows: Engine room, 40×65; boiler space, 40×60; and fuel-room, 40×50. The engine-room is double-floored, with bottom part of pine and upper of oak, while the fuel-room is floored with bricks set edgewise.

A 300 horse-power Harris-Corliss condensing engine, with 24×48 cylinders, will be used, having a 20-ton fly-wheel 20 feet in diameter by 38 in face, and making 70 revolutions per minute. From this two belts, 16 and 20 inches respectively, will be run to two different lines of shafting, these shafts being placed midway between floor and ceiling on oak columns. The belts run at an angle of about 45° through the upper floor to the dynamos.

In addition to the Corliss engine, one Buckeye, of 125 horse-power, and one of Prof. Sweet's Straight Line engines, of 55 horse-power, will be used—the former for all-night lights and the latter for day lights, and also for furnishing power for repair-shops in station.

The source of water supply is threefold, viz., city pressure, also large spring on the premises, and from the Mississippi river 600 feet distant, from which water is drawn through a 6-inch pipe for condensing purposes, and feeding boilers in case of emergency. One Knowles, one Robert pump and one Monitor injector are used. There are six tubular boilers, 60 inches × 16 feet, having fifty 4-inch flues in each. Two circuits of pipe are made to the engine—one 6 and one 8 inch—and, in case of necessity, either or both could be used. The smoke-stack, which is of ¼-inch iron, is 60 inches diameter × 125 feet high. The second story, which is 15 feet high × 40 × 125, is divided off as follows: Office, 15 × 25 feet; dynamo-room, 40×75; store-room, 20×25, the repair shops occupying the remainder. Belts all come through from shafting located in the engine-room.

One of Mr. Donaldson's many useful ideas has taken form in the shape of a switch board of Pennsylvania slate stone, 2 inches thick, 4 feet wide and 6 feet long, which, being a perfect insulator, prevents short-circuiting in case of moisture. It is made for 50 circuits and 50 dynamos, and by an ingenious device of the inventor, in case of accident to one dynamo coupled with another, the injured dynamo can be cut out and another connected without breaking the circuit, and all accomplished in a few seconds.

The store-room will be complete with shelving and drawers for carbons, globes, etc., while the repair shops will be equipped with a full set of tools, including lathes planer, drill-press, etc. They are now running over 250 arc-lamps with present engine and boiler capacity for 500, and building capacity for 1,500.

St. Paul can certainly boast of one of the finest stations to be found anywhere, the credit of the architecture and plans for which are due Mr. Donaldson.

We congratulate the Gas Light Company, not only from the wisdom of its policy in introducing the electric light, but also on having so practical a man in charge, and under whose management it is sure to succeed.

——The Schuyler Electric Light Company has introduced in Richmond, Va., an electric motor to run sewing machines. A reporter saw one in operation at the residence of Mr. Andrew Pizzini, Jr., and found it to work like a charm. This is the fifth one that Mr. Pizzini has tried, and it is the only one that has given entire satisfaction.

—— General Superintendent Davis of the U. S. Electric Light and Power Company, Baltimore, writes to Chas. A. Schieren & Co., belt manufacturers of this city, as follows: "The 24 and 30-inch electric belts made with cable screws furnished us by you, are running to-day with the same correctness, without stretch, as when first put up. The 30 inch belt drives all our machinery, the 24-inch belts are distributors, and all work beautifully. I can cheerfully recommend the Electric to all who want a good reliable belt."

—— In some engine-rooms that we know of, says an exchange, there are carpets down the center and a bright oilcloth close to the engine and all about it. There are even pictures on the walls, and plants in pots in the windows. The engine does not say a word. Beyond the sighing of the exhaust and the "creep" of the main belt, as it parts from the pulley, there is not a sound to indicate that there is a tremendous force at work. Contrast this with the hammer and tongs, a clatter like Bedlam broken loose, broken windows, and floors like an oil works for filth, and we have just the difference between thrift and sloth, between care and carelessness, between proper economy and the "willful waste" that sooner or later "makes woful want."

—— At a recent meeting of the Waltham Board of Trade, a committee, consisting of Messrs. H. A. Snow, F. A. Foster, W. D. McWain, S. W. Boynton and Henry Bond, was appointed to confer with the agents of various electric light companies, with a view of establishing, if possible, a plant in Waltham. The committee, after consulting with the agents, prefers the incandescent light for indoor use, and the arc for street use. This system it will recommend at the meeting of the Board of Trade, and steps will at once be taken to form a stock company. It is said to be generally understood that, provided the townspeople will take no definite action in the matter, three out-of-town men, who are already interested in two plants elsewhere, will put the plant in.

—— A communication has been received by the city council at Paterson, N. J., from the American Electric Manufacturing Company, of East Eighteenth street, New York, stating that they could comply with the requirement proposed by Alderman Cooke in furnishing both the arc and the incandescent light. The two systems could be put in the same building, and the wires run on the same poles, without interference. They claimed to have the exclusive right to use the Edison incandescent light in connection with their own patents, and they were willing to make a pledge to at once put up a station for the production of both sorts of light, provided the city would give them the right to run the poles and wires through the streets. The matter was referred to the Street Committee.

—— An engineer put in charge of an electric-light station found them using oil of twenty-six gravity for lubricating the engine and dynamos. Even when the oil was used freely the bearings would warm up and sometimes get hot. It was the practice to increase the quantity of oil as the journals got warmer, and turn on water, when the oil would run all over. To the engineer's surprise one night he discovered that one of the bearings kept cool, and he noticed also that the oil-cup was feeding only about one-quarter as fast as had been the practice. The happy idea of "letting well enough alone" occurred to him, and he found it continued to run cool. In experimenting, he proved that by feeding little enough oil, he got the other bearings to run cool also, upsetting the generally accepted notion that the white man entertains about oil, and the Indian about whiskey, which you will remember is that "a little too much is just enough." Whether the machines were endowed with homeopathic proclivities, whether the lubricant was of a high potency, or whether the result was due to the personal equation of the operator, are questions about which there may be difference of opinion.

ELECTRIC LIGHT NEWS

—— Bowling Green, Ky., is having the electric light plants of surrounding cities inspected, with the view of adopting a similar illuminant.

—— The contract for lighting the new Custom House and Post Office, in Kansas City, Mo., has been let to the United States Electric Light Company.

—— The prospect is that in the near future Troy, N. Y., will be one of the best lighted cities in the country. This result has been reached none too soon to satisfy her citizens.

—— A Cincinnati paper asks: "Why should not the central portion of our city be supplied with electric light, or is it feared that our dirty streets would show too plainly, if the flickering gas were banished?"

—— It is understood that the Brooklyn Board of Aldermen intend to bring in a resolution directing that the city be entirely lit by electricity, as the gas companies refuse to reduce the price for lighting the streets.

—— Mr. J. H. Marshal, formerly with the Grand Rapids Electric Light and Power Company, and who recently associated himself with Mr. Jno. R. Markle, of Detroit, Michigan, and has opened an office in Grand Rapids.

—— Richmond, Va., is negotiating with the Schuyler Company to have the electric lights continue all night, instead of from dusk to midnight as heretofore. They think a whole loaf of excellent bread better than half of one.

—— The opponents of the electric light in Cleveland were again sat down upon by a vote of thirty-two to fifteen in the City Council, and the Board of Improvements ordered to enter into contract with the Brush Electric Light Company.

—— The Brooklyn Electric Light Company filed a certificate of incorporation in the Kings County Clerk's office last week, showing a capital of $50,000, and the following incorporators: Albert M. Kalbfleisch, John A. Nicholas, W. W. Goodrich and Edward B. Bartlett.

—— Some of the citizens of Washington, D. C., petitioned Congress to remove the electric light works on account of the noise and noxious air generated. If the works should be removed clear out of the city, there would probably be another petition asking that the darkness be removed.

—— An accident in Detroit proved the aptness of the statement made before the Electric Light Convention by Mr. C. J. H. Woodbury, to the effect that a "lineman is in infinitely greater danger from gravity than from electricity." One of the trimmers fell from the top of a Detroit electric light tower, the fall of 140 feet killing him instantly.

—— A device has been invented by which electricity is made to record the weights indicated upon scales or steelyards, the application being specially designed for the weighing of freight cars while in motion. It is said that with this device properly applied to the scales, an accurate account can be kept of the weight of every car passing over them, even at full speed.

—— Messrs. W. A. Sheldon and A. S. Huey, of the Municipal Electric Lighting and Construction Company, Minneapolis, are about moving into their new and more spacious office on Fifth street opposite the West Hotel. They will occupy a first floor and basement, 22x85, which will be nicely fitted up for an exhibit of an incandescent system, etc.; heat and power for which will be supplied from their boiler and engine in basement. This company does a general construction business, and its contracts already completed demonstrate the enterprise of the men behind it.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING FEB 23, 1886.

336,562 Electric signaling apparatus; Ezra T. Gilliland, Boston, Mass., assignor to the American Bell Telephone Co., same place.

336,563 Looping-in switch; Ezra T. Gilliland. Boston, Mass., assignor to the American Bell Telephone Co., same place.

336,608 Regulator for dynamo-electric machines; John E. Watson, Louisville, Ky.

336,629 Electric motor; Leo Daft, Greenville, N. J.

336,635 Electric arc-lamp; Jean M. A. Gerard-Lescuyer, Paris, France.

336,636 Dynamo-electric machine; Jean M. A. Gerard-Lescuyer, Paris, France.

336,637 Incandescent electric lamp; Jean M. A. Gerard-Lescuyer, Paris, France.

336,643 Electrical call or signaling apparatus; Alfred G. Holcombe, New York, N. Y., assignor to the Equitable Electric Co., same place.

336,653 Convertible telegraph key; James A. Maloney and Andrew G. Johnson, Washington, D. C.; said Johnson assignor to said Maloney.

336,688 Ammeter; John A. Barrett, Brooklyn, N. Y.

336,716 Rheostat for incandescent electric lights; S. Ambrose Hill, Sunbury, Pa.; George Hill, administrator of S. Ambrose Hill, deceased.

336,729 Incandescent electric lamp; Wm. Main, Brooklyn, N. Y.

336,744 Telephone; Charles A. Randall, New York, N. Y.

336,773 Alarm for detecting water overflow; Leopold Weil, New York, N. Y.

336,780 Dynamo-electric machine; Royal E. Ball New York, N. Y.

336,809 Electrical communicating systems for hotels; Alfred G. Holcombe, New York, N. Y., assignor to the Equitable Electric Co., same place.

336,876 Telephone transmitter; Wm. C. Turnbull Baltimore, Md.

336,877 Telephone transmitter; Wm. C. Turnbull Baltimore, Md.

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Pennsylvania R. R. Ferry,	Equitable Building,	Union Club,
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"Among the different systems of arc lighting may be mentioned the Brush, the Weston, the Schuyler, the Thomson-Houston, and the Fuller-Wood (hereafter to be known as the American). The Fuller-Wood system of arc lighting has gained a world-wide reputation for reliability and economy. This organization was originally known as the Fuller Electrical Company, which dates its existence from 1878. This system was the foundation of the well-known Gramme Association, being the party of the first part in the articles of association, which was composed of the Brush, Weston, United States, Thomson-Houston, Edison and Jablochoff companies, which was good evidence that all the companies composing that association were willing to pay tribute to the superior merit of the Fuller Wood system.—*N. Y. Sun, Sept. 27th*, 1885.

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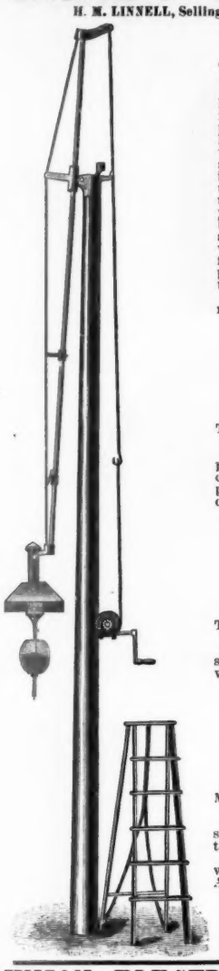


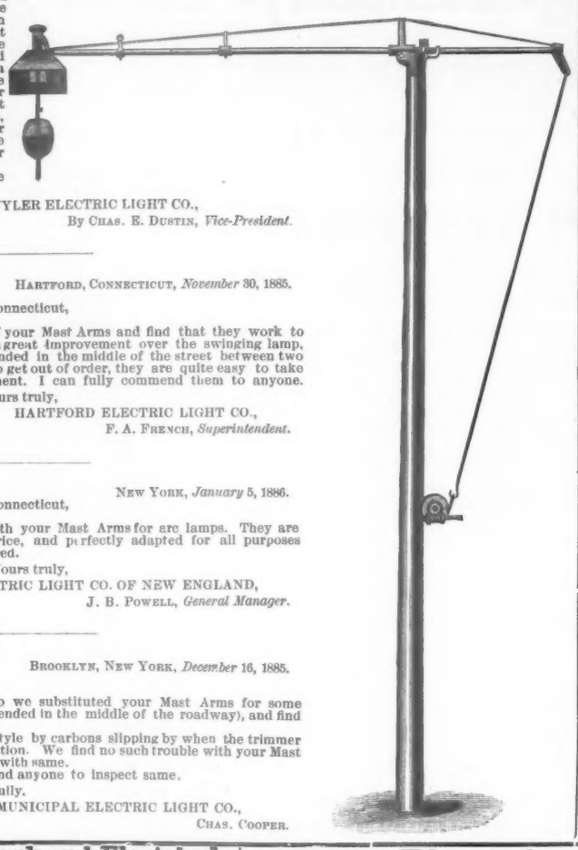
HARTFORD, CONNECTICUT, *December* 29, 1885.

THOMAS H. BRADY, Esq., New Britain, Connecticut.

Dear Sir.—We take pleasure in giving you our experience with the Electric Light Mast Arm manufactured by you. We have had experience with mast arms manufactured by others and can unhesitatingly pronounce yours the best, both as regards ease in working and permanent durability, of any we have used. In connection with this we will say that several of our workmen have invented mast arms that we could undoubtedly manufacture at a trifle less than we can purchase yours, but as an evidence of our belief that yours is the cheapest and best for us in the long run, we have sent you the order for fifty of your Mast Arms for the plant which we have erected for the City of Richmond, Va.

Wishing you every success we remain, Yours very truly,

SCHUYLER ELECTRIC LIGHT CO.,
By CHAS. E. DUSTIN, *Vice-President.*



HARTFORD, CONNECTICUT, *November* 30, 1885.

T. H. BRADY, Esq., New Britain, Connecticut,

Dear Sir.—I have used several of your Mast Arms and find that they work to perfection and also that they are a great improvement over the swinging lamp, or, in other words, a lamp suspended in the middle of the street between two poles. They are much less liable to get out of order, they are quite easy to take care of, and are quite an ornament. I can fully commend them to anyone.

Yours truly,
HARTFORD ELECTRIC LIGHT CO.,
F. A. FRENCH, *Superintendent.*

NEW YORK, *January* 5, 1886.

T. H. BRADY, Esq, New Britain, Connecticut,

Dear Sir—I am much pleased with your Mast Arms for arc lamps. They are simple in construction, low in price, and perfectly adapted for all purposes where projecting lamps are required.

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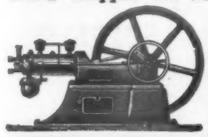

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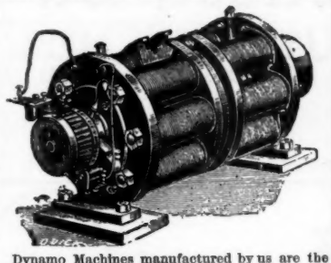

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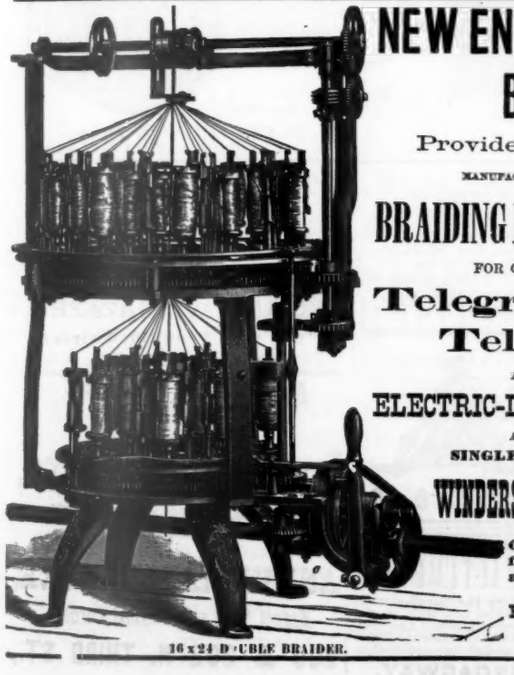

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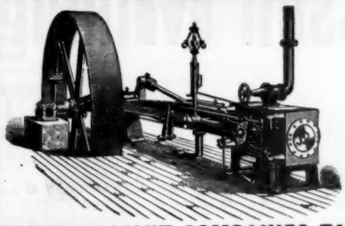

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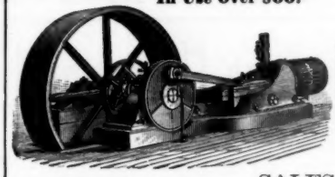

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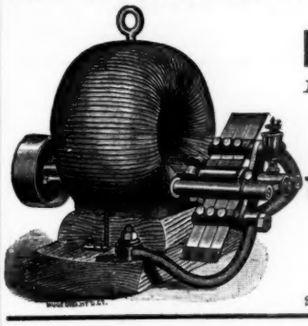

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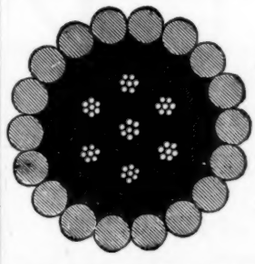

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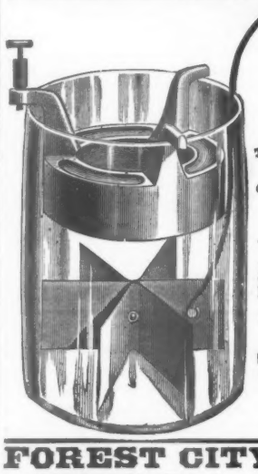

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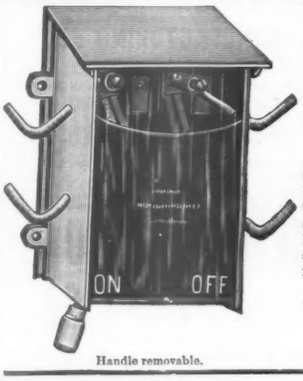

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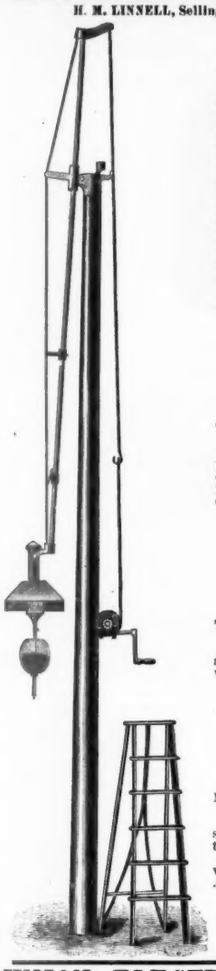

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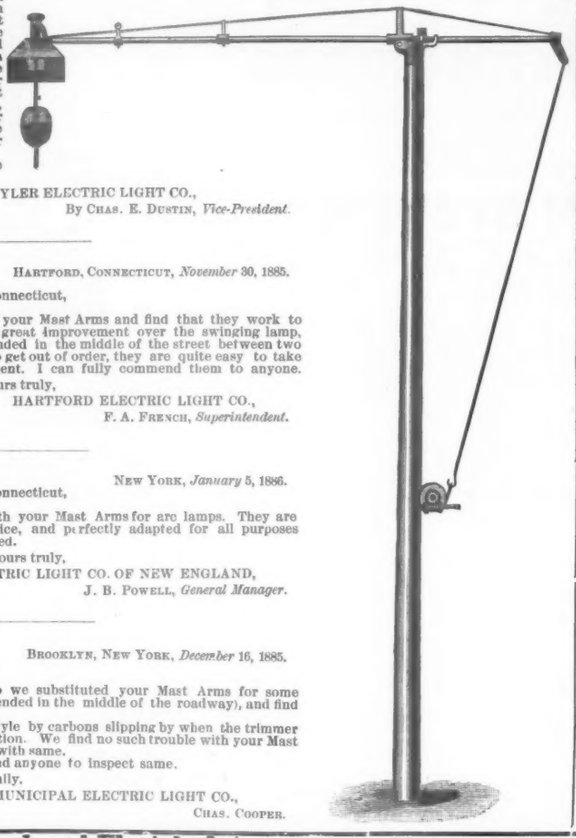
Dear Sir.—We take pleasure in giving you our experience with the Electric Light Mast Arm manufactured by you. We have had experience with mast arms manufactured by others and can unhesitatingly pronounce yours the best, both as regards ease in working and permanent durability, of any we have used. In connection with this we will say that several of our workmen have invented mast arms that we could undoubtedly manufacture at a trifle less than we can purchase yours, but as an evidence of our belief that yours is the cheapest and best for us in the long run, we have sent you the order for fifty of your Mast Arms for the plant which we have erected for the City of Richmond, Va.

Wishing you every success we remain, Yours very truly,

SCHUYLER ELECTRIC LIGHT CO.,
By CHAS. E. DUSTIN, *Vice-President.*



HARTFORD, CONNECTICUT, *November* 30, 1885.

T. H. BRADY, Esq., New Britain, Connecticut,

Dear Sir.—I have used several of your Mast Arms and find that they work to perfection and also that they are a great improvement over the swinging lamp, or, in other words, a lamp suspended in the middle of the street between two poles. They are much less liable to get out of order, they are quite easy to take care of, and are quite an ornament. I can fully commend them to anyone.

Yours truly,
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NEW YORK, *January* 5, 1886.

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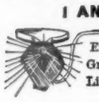

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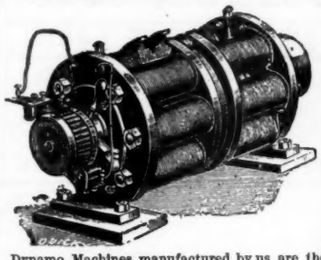

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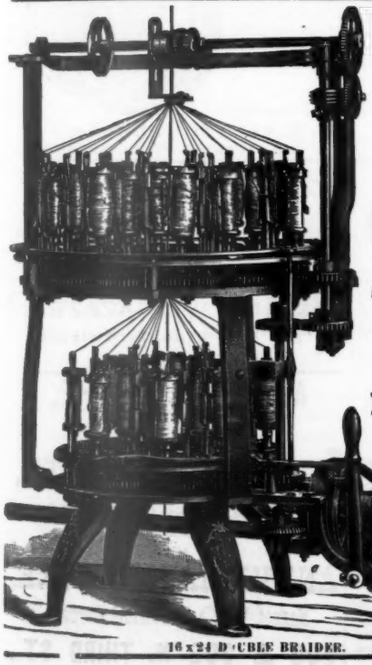

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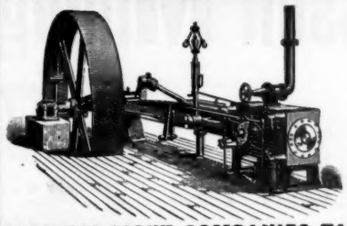

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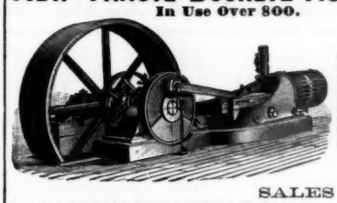

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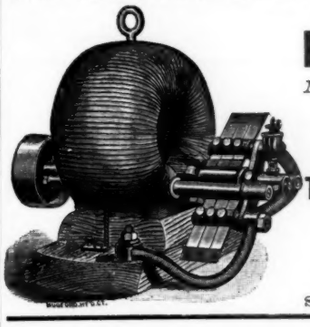

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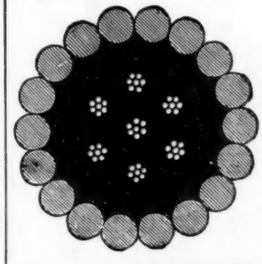

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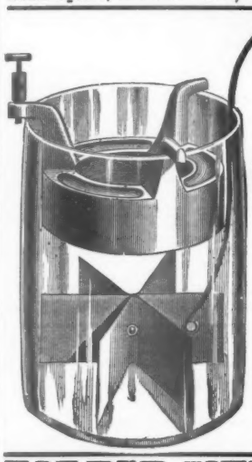

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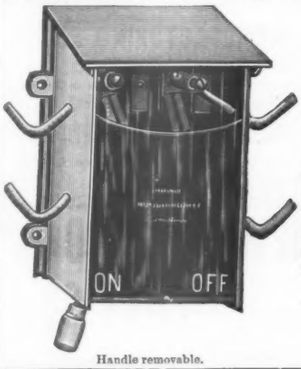

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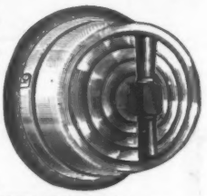

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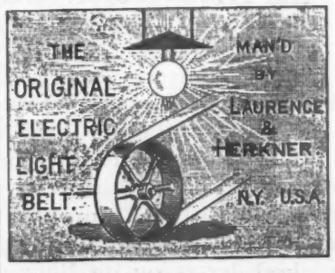

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